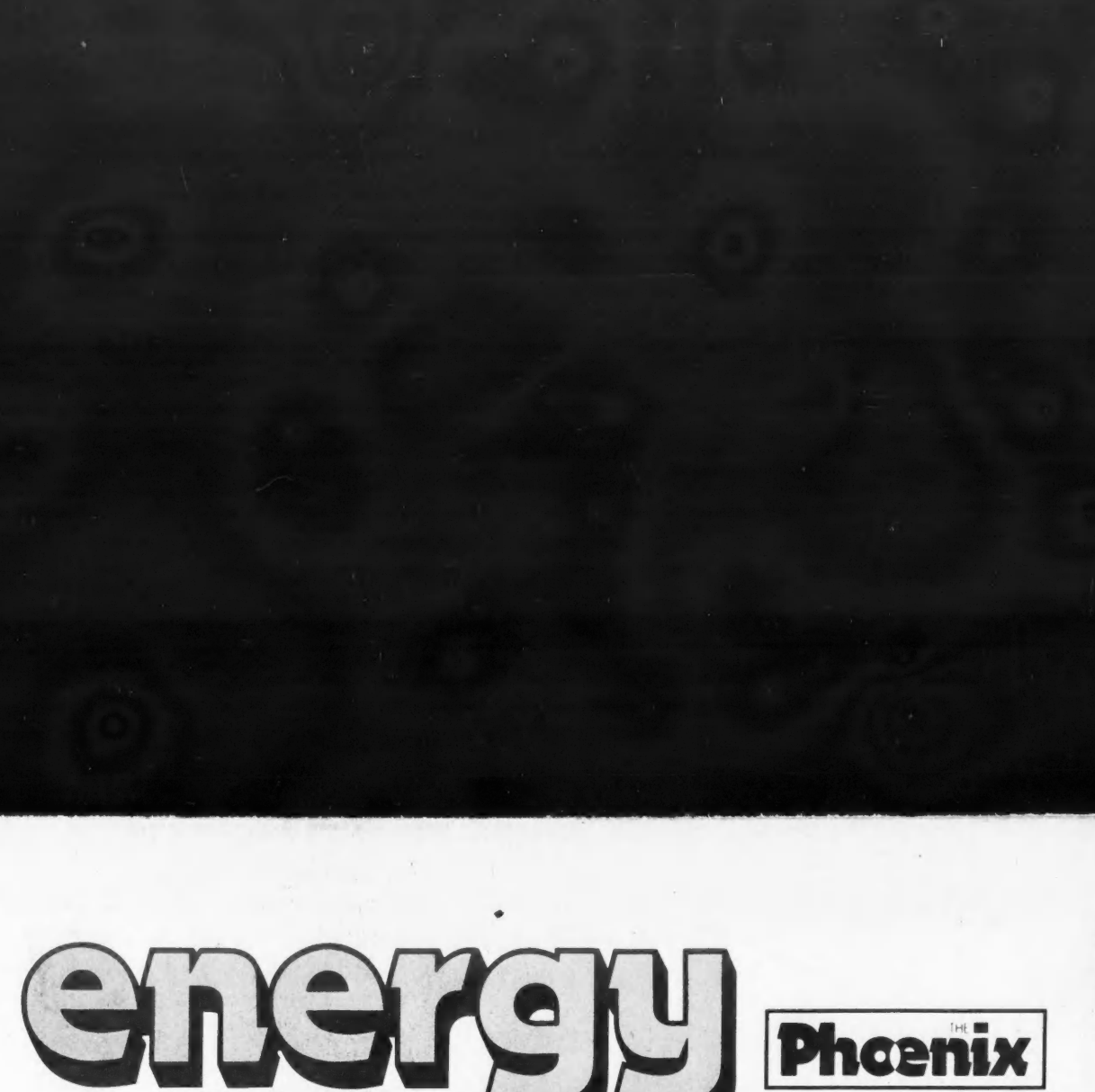
MAGAZINE SUPPLEMENT, SEPTEMBER 30, 1980

energy

THE Phoenix

Official Guide to the New England Energy Expo, October 2 through 5 at the Commonwealth Pier Exhibition Hall



Lucy Dillon

Schedule of Expo events, plus technology for the future, home energy audits, and solar humor

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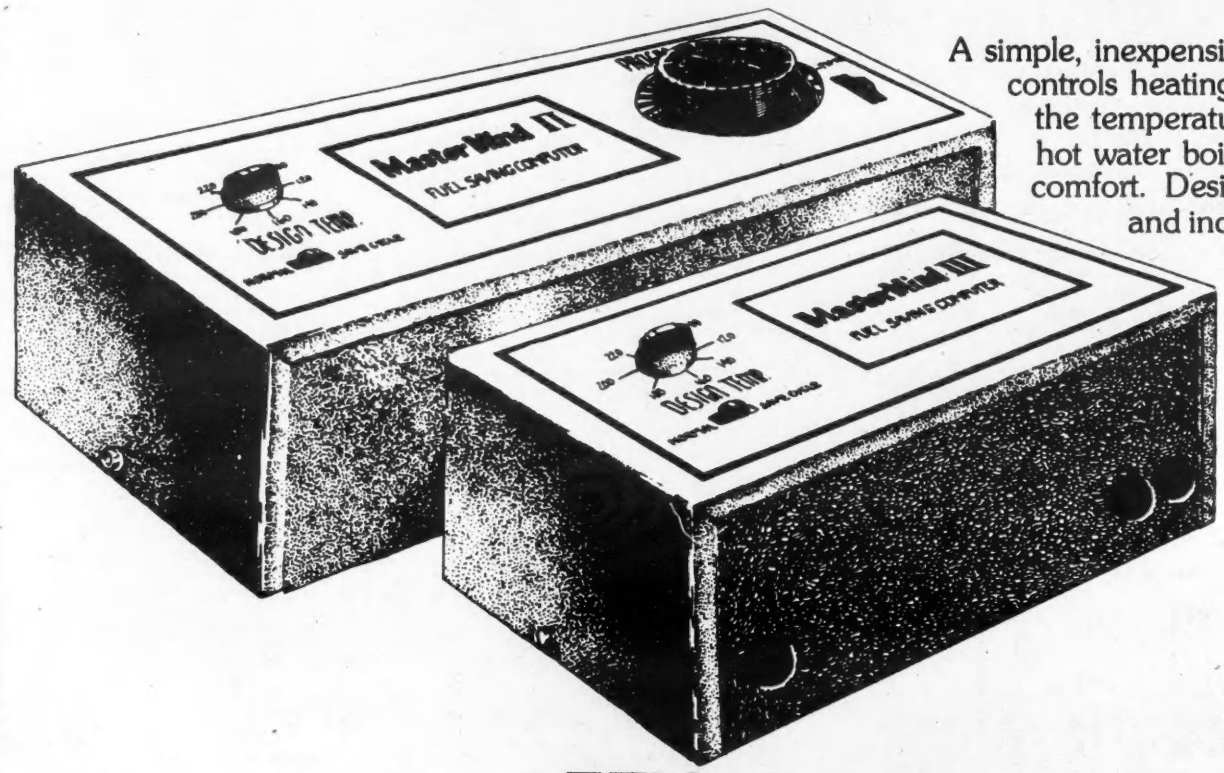

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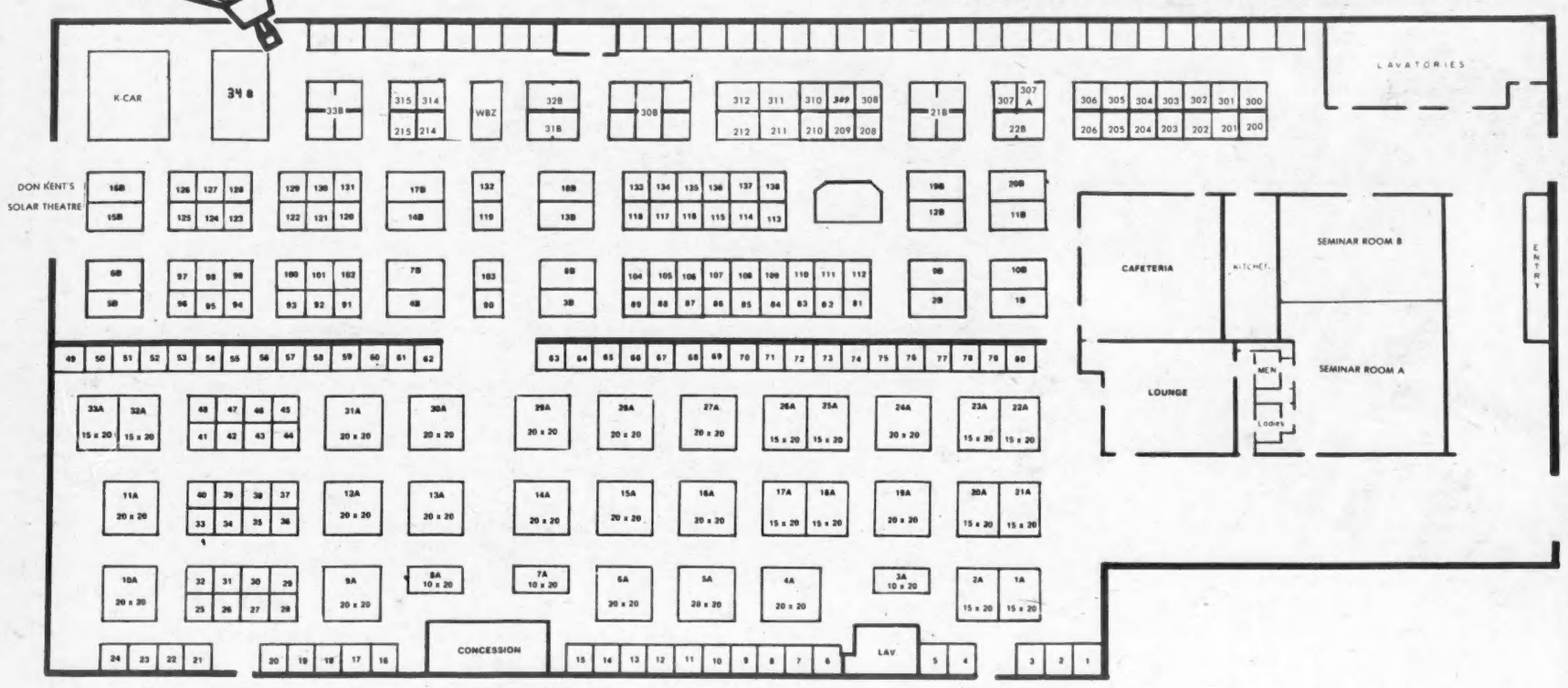
Thursday, October 2, 10 a.m. to 10 p.m.
Friday, October 3, noon to 10 p.m.
Saturday, October 4, 10 a.m. to 10 p.m.
Sunday, October 5, 10 a.m. to 6 p.m.

Commonwealth Pier Exhibition Hall



Exhibitors listed by category of product or service

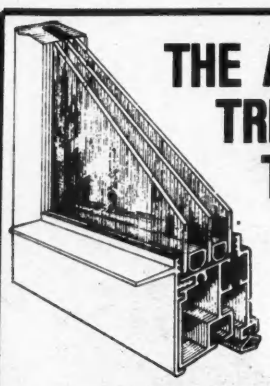
The New England Energy Expo, at the Commonwealth Pier Exhibition Hall October 2 through 5, will comprise more than 300 exhibits, including electric and solar cars, wind-energy applications, solar-energy systems, insulation materials, wood- and coal-burning stoves, and energy-management systems. Each day, seminars will include talks on home use of solar energy, by Don Kent, radio and television weatherman and a long-time solar-energy proponent. Also daily, WBZ radio will broadcast live from its mobile unit at the Expo.

Governor King, along with Denis Hayes, director of the Solar Energy Research Institute, in Boulder, Colorado, will be present at the Expo's opening, at noon on Thursday, October 2. The opening ceremony will kick off Massachusetts Energy Conservation Week as well.

Wood- and coal-burning stoves and accessories

14B **Abundant Life Woodstoves**, Box 175, Lochmere, NH 03252, (603) 524-0891
19A **Alaska Company Inc.**, 480 West 5th St., Bloomsburg, Penn. 17815, (800) 233-8976
95, 96 **American Energy Marketing**
136, 137 **Association**, 4642 Crossroad Park Drive, Liverpool, NY 13088, (315) 457-3787
2B **American Stovalator**, East Manchester Road, Manchester Center., Vt. 05255, (802) 362-1494
214, 314 **Belmont Industries**, 155 John St., Reading 01867, 944-1111
63, 64 **Garrison Stove Works**, Airport Road, Claremont, NH 03743, (603) 542-8761
45 **Gateway Industries Inc.**, 9603 Girard Ave. South, Minneapolis, Minn. 55431, (612) 888-2170
61 **Greenwood Energy Corp**, Executive Drive, Hudson, NH 03051, (603) 883-7877
102, 7B **H&H Sales Inc.**, RFD 1, Box 119, Laconia, NH 03246, (603) 366-4683
97 **Improved Consumer Products**, 10 Town St., Attleboro Falls 02763, 695-7000
86 **Long Manufacturing**, Box 259, Mechanicsburg, Penn. 17055, (717) 697-8277
3A **Plymouth Stove Co.**, 37 County Rd., Rte. 106, Plympton, 02367, 585-3887
116 **Prairie Wood Boilers**, Prairie Farm, Wis. 54762, (715) 472-8206
13A **Pro Former Engineering**, Cachoto Industrial Park, Holbrook 02343, 767-3311
11B **Russo Wood Stove Mfg.**, 87 Warren St., Randolph 02368, 963-1182
104 **Tirolia of America**, 169 Dunning Rd., Middletown, NY 10940, (914) 343-5900
35 **Wellington Stove Inc.**, North Harbor Plaza Bldg., 701A Rte. 25A,

Continued on page 4



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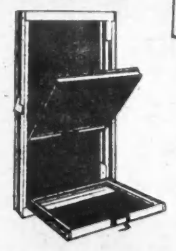

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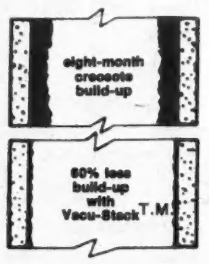

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Rocky Point, NY 11778, (516) 744-4100

44 **The Energy Forum**, 672 Pleasant Point, Norwood 02062, 762-9260

10, 31B **Woodex of New England**, 1140 Saratoga St., East Boston 02128, 569-5120

31A **Darmody Associates**, Box 119, Sparta, NJ 07871, (201) 729-6253

30B **Cambridge Alternative Power Co.**, 1B Monsignor O'Brien Hwy., East Cambridge 02141, 227-9160

2A **New England Hardwood Firewood Co. Inc.**, Little City Road, Higganum, Conn. 06441, (212) 476-1861

106 **Crane Stove Works Inc.**, Box 440, Braintree 02184, 843-6150

52 **Malm Fireplaces**, 368 Yolanda Ave., Santa Rosa, Calif. 95401, (707) 546-8955

203 **Advanced Energy**, 111 Southwest Cutoff, Worcester 01613, 754-1125

84 **Superior Stoves**, 159 Mill St., Stoughton 02072, 344-9342

100 **G.E. Davis Co.**, 515 Madison Ave., Kansas City, Mo. 64105, (816) 421-8190

300, 301 **J&D Associates**, 2978 Brown Ave., Manchester, NH 03103, (603) 624-4949

308, 309, 310 **Sterling Distributors**, 60 Break Neck Rd., Southborough 01722, 485-5875

202 **Master Chimney Sweeps**, Box 48, Babson Park 02157, 235-8618

81 **United States Coal Inc.**, Box 8782, Boston 02114, 471-5035

126, 127, 128 **Sierra Manufacturing Co.** Box 346, Harrisonburg, Va. 22801, (800) 336-4067

87 **Greenbriar Fireplace & Stove**, Box 473, Spring Green, Wis. 53588, (608) 588-2923

123 **National Steel Crafters**, Box 56, Gastonia, NC 28052, (704) 867-8821

57 **Burning Embers Distributors**, Box 61, Syracuse, NY 13208, (315) 454-0072

91 **American Solid Fuels Inc.**, 610 State St., Portsmouth, NH 03801, (603) 436-4733

99 **Double Comfort Inc.**, Sub. of Eastern Metal Inc., 1430 Sullivan St., Elmira, NY 14901, (607) 734-2295

8A **MacGregor Stoves**, c/o Feron Company, 45 Wright Ave., Dartmouth, Nova Scotia, Canada B3B1H1

Oil and gas burners and plumbing and heating equipment

69 **Belcher of New England Inc.**, 222 Lee Burbank Rd., Revere 02151, 284-4490

117, 118 **Essex Company Heating & Plumbing**, Rte. 1, Rowley 01969, 948-7770

45 **Gateway Industries Inc.**, 9603 Girard Ave. South, Minneapolis, Minn. 55431, (612) 888-2170

312 **Midway Heat Supply**, 187 Summer St., Worcester 01608, 755-6589

20A **New England Combustion Products**, 1325 Pleasant St., East Weymouth 02187, 288-1100

70 **Leo C. Pelkus**, 170 Worcester Rd., Wellesley 02181, 235-8040

67 **Republic Plumbing & Heating**, 890 Providence Hwy., Norwood 02062, 762-3900

105 **R.K. Thomas & Son**, 233 Main St., Plaistow, NH 03865, (603) 382-5235

112 **Scott Energy Systems**, 200 Riverside Park, Weston 02193, 891-9100

27 **Michigan Furnace**, 574 Robbins Dr., Troy, Mich. 48084, (313) 588-1668

41 **ABC-Sunray**, 45 South Service Rd., Plainview, NY 11803, (516) 293-6800

65, 66 **John Oldach Association Inc.**, Industrial Heat Reclaimers, 591 North Ave., Wakefield 01880, 246-1180

31A **Ista Energy Systems Corp.**, 29 South Union St., Cranford, NJ 07016, (201) 272-2822

20A **George T. Wilkinson Inc.**, 1325 Pleasant St., East Weymouth 02189, 335-2622

26A **Sam Goldberg & Sons**, 126 Sohier Rd., Beverly 01915, 922-6400

108, 109 **Supino Brothers**, 308 Main St., Everett 02149, 389-1901

33 **Fraser Engineering Co. Inc.**, 63 Court St., Newtonville 02160, 332-3700

300, 301 **J&D Associates**, 2978 Brown Ave., Manchester, NH 03103, (603) 624-4949

94 **Energy Independence Inc.**, 71 Boylston St., Brookline 02147, 739-2010

Building products

17B **Badala Alumnium Products**, 105 Bullard Rd., Walpole 02081, 668-2787

14A **Brockway Smith Co.**, 146 Dascomb Rd., Andover 01810, 475-7100

208 **Channel Home Center**, 945 Rte. 10, Whippany, NJ 07981, (201) 887-9000

72 **Flexibulb Inc.**, 1820 Brebeuf St., Trois Rivieres, Quebec, Canada G8Z2A5, (418) 545-2800

9B **Heldor Associates Inc.**, 1 Corey Rd., Morristown, NJ 07960, (201) 267-4455

18B **Kom Craft Inc.**, 535 North Midland Ave., Saddlebrook, NJ 07662, (201) 791-1511

62 **Mass Glass**, 163 Old Colony Ave., Boston 02108, 269-4374

4B **Northeast Improvement Co.**, 215 Salem St., Medford 02155, 391-3460

113 **Nu-Window Systems**, 200 Maplewood St., Malden 02148, 324-5513

68 **Star Manufacturing**, Box 94910, Oklahoma City, Okla. 73143, (405) 636-2288

12A **Sto Energy Conservation Inc.**, Quality Lane, Rutland, Vt. 05701, (802) 775-1919

3B **Viking Energy Systems Co.**, 275 Circuit St., Hanover 02339, 871-3180

6A **C.E. Morgan**, Box 1353, Framingham 01701, 872-3981

135 **Perma-Sash Window Systems Inc.**, 100 Main St., Reading, 01867, 944-5500

121, 122 **Hadco Home Improvements**, 9 East St., Boston 02111, 426-7890

Insulation products and installation

8B **American Thermal Technology**, Box 6392, Providence, RI 02940, (401) 722-5600

134 **Bay State Gas-Conserv.**, 61 Glen St., Lawrence 01842, 682-5613

8B **Insulation Corps. Inc.**, 313 Washington St., Newton 02158, 965-0227

24A **Insultek Corp.**, 82 Cresswood Rd., Rockaway, NJ 07866, (201) 625-3838

138 **Map Insulation**, RFD 1, Buzzards Bay 02532, 888-3599

90, 103 **Mass Modernizing Insulation Corp.**, 322 North Main St., Randolph 02368, 963-4340

115 **New Look Improvements**, 32 Deerfield Rd., Sharon 02067, 828-1728

305 **Massachusetts Insulating Contractors Assn.**, 6 Margaret Rd., Foxboro 02035, 543-5166

307 **Gelpey Construction & Insulation**, 20 Howley St., Peabody 01960, 531-0710

4A **NRX Technology**, 630 Fifth Avenue, Suite 950, New York, NY 10111, (212) 582-0180

Ventilation, air conditioning, and heat pumps

1B, 10B **Environomics**, 1 Johnny Cake Hill, New Bedford 02740, 994-7600

74 **Globe Engineering**, 270 Monroe Ave., Kennilworth, NJ 07033, (201) 276-1335

19A **Supply Distributors Inc.**, 50 Revere Beach Pkwy., Medford 02155, 395-8100

55 **Enviro Fan Systems Inc.**, 730 Young St., Buffalo, NY 14223, (716) 692-0610

21A **Spectra Products Inc.**, 43 Washington Ave., Suite 202, Endicott, NY 13760, (607) 785-5156

Solar equipment, products and installation

22A **Advanced Solar Components**, 361 Moraine St., Brockton 02401, 588-0860

60 **Alternate Energy Industries**, 77 Thames St., Newport, RI 02840, (401) 846-9568

120 **Century Products Inc.**, 171 Medford Ave., Malden 02148, 628-2950

37 **Colkar Solar — Lamco**, 2500 Office Center, Maryland Rd., Willowgrove, Penn. 19090, (215) 657-6506

16B **Don Kent Solar**, 288 Washington St., Weymouth 02188, 337-5300

206 **Solar Energy Products of New England**, 750 Exeter Rd., Hampton, NH 03842, (603) 778-7662

9B **Heldor Associates Inc.**, 1 Corey Rd., Morristown, NJ 07960, (201) 267-4455

7A **Helio Therm Inc.**, 450 West Lenni Rd., Lenni, Penn. 19038, (215) 459-9030

107 **Kane of New England**, 64 Rogers St., Cambridge 02142, 864-1044

112 **Scott Energy Systems**, 200 Riverside Park, Weston 02193, 891-9100

88 **Sippican Solar**, 732 Mill St., Marion 02738, 748-2870

13A **Solar Processes Inc**, 11 Velvet Lane, Mystic, Conn. 06355, (203) 536-4229

80 **Solar Products Mfg. Corp.**, 1 Alcap Bridge, Cromwell, Conn. 06416, (203) 635-0266

129, 130 **Solar Usage Now**, Box 306, Bascom, Ohio 44809, (419) 937-2226

29A **Valve Services International**, 105 Congress St., Lowell 01852, 458-8797

21B **Windmills — The Energy Store**, 45 Lafayette St., Salem 01970, 744-8362

19B **Yankee Solar**, Energy Saver Bldg., Rowley 01960, 525-3100

111 **American Sunsystems**, 158 Cherry St., Milford, Conn. 06460, (203) 877-6021

19B **Solar Solutions**, 43 River St., Winchester 01890, 721-1183

19B **March & Martin Inc.**, 66 Washington St., Salem 01970, 745-3223

307A **Solar Concepts Building Co.**, 30 Bow Rd., Wayland 01778, 358-5212

133 **Bicknell Inc.**, Rte. 30, Framingham 01701, 879-6660

59 **Sun Use Engineering**, 150 Amarel St., East Providence, RI 02915, (401) 438-9369

9B **Natural Energy Design Inc.**, 1355 Green End Ave., Middletown, RI

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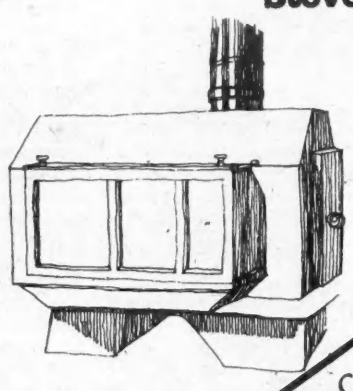

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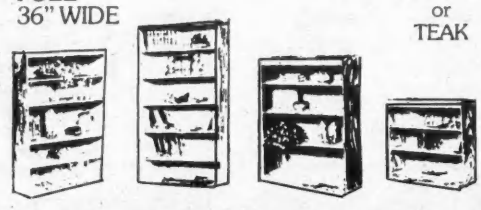

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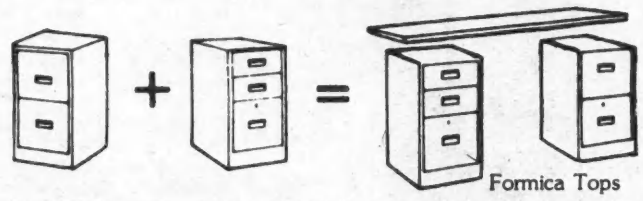

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30B **Cambridge Alternative Power Co.**, 1B Monsignor O'Brien Hwy., East Cambridge 02141, 227-9160

204 **Solar Science Industries**, 10762 Tucker St., Beltsville, Md. 20705, (301) 474-6511

26 **Mor-Flo Industries**, 18450 South Miles Rd., Cleveland, Ohio 44128, (800) 321-9342

19B **New England Energy Alternatives**, 1629 Central St., Stoughton 02072, 828-7990

19B **Power Solar Engineering**, 197 Ferry St., Malden 02148, 324-8243

303 **Northeast Solar Energy Center**, 470 Atlantic Ave., Boston 02110, 292-9414

131 **Solex Solar Energy Systems Inc.**, 444 Bedford Rd., Pleasantville, NY 10570, (914) 747-0786

200 **Jim Williams Builder Co.**, 379 Main St., Haverhill 01830, 372-9602

308, 309, 310 **Sterling Distributors**, 60 Break Neck Rd., Southborough 01722, 485-5875

311 **Bursaw Oil Inc**, 27 Cherry St., Danvers 01923, 777-0700

13 **Aerospace Systems Inc.**, Energy Systems Division, 121 Middlesex Tpk., Burlington 01803, 272-7517

16, 17, 18 **Oneida Heating Company Inc.**, 109 North Warner St., Oneida, NY 13421, (315) 363-5500

Multi-fuel boilers

300, 301 **J&D Associates**, 2978 Brown Ave., Manchester, NH 03103, (603) 624-4949

15A **Repco**, 7400 State Rd., Philadelphia, Penn. 19136, (215) 338-1110

114 **Stadler Corp**, Box 180C, Carlisle 10741, 369-0415

27A **Tekton**, Route 116, Conway 01341, 879-6070

30B **Cambridge Alternative Power Co.**, 1B Monsignor O'Brien Hwy., East Cambridge 02141, 227-9160

1A **B&P Industries**, 110 Pleasant St., Marlboro 01752, 481-3810

Lighting controls, friction heaters, and radiant heaters

71 **FrictionAir Northeast Inc.**, 141 Canal St., Nashua, NH 03060, (603) 880-3402

119 **Needham Oil**, 355 Chestnut St., Needham 02192, 444-3600

93 **New England Radiant Heat**, 379 Boston Post Rd., Sudbury 01776, 443-4666

Heat-measuring devices

77 **Kent Meter Sales Inc.**, Box 1515, Ocala, Fla. 32670, (800) 874-0890

79 **Linear Laboratories**, 445 South San Antonio Rd., Los Altos, Calif. 94022, (415) 941-4996

48 **Howland Associates**, Box 212, Laconia, NH 03246, (603) 524-2009

Electric vehicles

17A, 18A **McNamara Import Sales**, Box Y, 5184 Nesconset Hwy., Port Jefferson Station, NY 11776, (516) 473-3009

33B **Northeast Electric Car Distributors**, 341 Newbury St., Boston 02116, 536-7694

Robert Steven Witcoff Design, 46 Kirkwood Drive, Glen Cove, NY 11542, (516) 676-0115

Energy-conservation products

28A **Pioneer Energy Products**, 6 Atlantic Ave., South Yarmouth 02664, 291-0200

29 **Sun Power Company Inc.**, 10 Appleleave Drive, Bedford, NH 03102, (603) 472-3856

30B **Cambridge Alternative Power Co.**, 1B Monsignor O'Brien Hwy., East Cambridge 02141, 227-9160

205 **Defender Energy Corp.**, Box 716, Mahopac, NY 10541, (914) 628-5880

211 **Trans Continental Energy Saving Products Inc.**, 80 East Hartsdale Ave., Hartsdale, NY 10530, (914) 946-6605

20A **Pittston Petroleum** (formerly Metropolitan Petroleum — Boston), 500 Neponset Ave., Dorchester 02122, 228-1100

22A **Regency Electronics**, c/o Montague Associates, 404 Jerusalem Rd., Cohasset 02025, 383-0634

129, 130 **Solar Usage Now**, 420 East Tiffin St., Bascom, Ohio 44806, (419) 937-2226

101 **3-C Company**, Division of Continental Chemical Corp., 219 New Boston St., Woburn 01801, 935-8585

Wind-generating equipment

124, 125 **Independent Energy Systems**, 6043 Sterrettania Rd., Fairview, Penn. 16415, (814) 833-3567

21B **Windmills — The Energy Store**, 45 Lafayette St., Salem 01970, 744-8362

30B **Cambridge Alternative Power Co.**, 1B Monsignor O'Brien Hwy., East Cambridge 02141, 227-9160

Publications

110 **Brickhouse Publishing Co.**, 3 Main St., Andover 01810, 475-9568

201 **Encyclopaedia Britannica**, 60 William St., Wellesley 02181, 237-7095

210 **Living Alternatives Magazines**, Box 189, Newton 02195, 965-5650

85 **Tech Pubs**, Box 2841, Woburn 01888, 245-1711

Energy-management controls

27A **American Energy Control**, 109 Concord St., Framingham 02701, 879-6070

75 **Atlantic Energy Technology**, 73 Tremont St., Boston 02108, 367-1602

21A **Balco**, 160 Charlemont St., Newton 02161, 964-1300

16A **Conservolite**, Box 215, Oakdale, Penn. 15071, (412) 787-8800

28 **Dytron Inc. — Energy Systems Division**, 241 Crescent St., Waltham 02154, 893-3532

36 **Eagle Signal Energy**, 30 Main St., Danbury, Conn. 06810, (203) 797-8800

89 **Emerson Swan**, 111 Lenox St., Norwood 02062, 762-9000

73 **Energy Management Inc.**, 200 Boylston St., Newton 02167, 964-7230

27A **Energy Master Sales**, 88 Terry Rd., Smithtown, NY 11787, (516) 265-0555

15 **Energy Savings Systems**, 20 Foster St., Bergenfield, NJ 07621, (201) 384-4410

78 **Newport Energy Conservation Inc.**, 42 Bay St., Newport, Vt. 05855, (802) 334-2065

16A **Sentinel Energy Control**, 8 Blanchard Rd., Burlington, Mass. 01803, 273-1776

6B **Simplex**, Simplex Plaza, Gardner, 01441, 632-2500

24A **American United Industrial**, 5 Broadway, Rte. 1, Saugus 01906, 231-0622

40 **Forrest Gould Co.**, 16 Eaton Square, Needham 02192, 444-0562

31A **Power Unity**, 298 East 149th St., Bronx, NY 10451, (212) 292-9100

22A **Regency Electronics**, c/o Montague Association, 404 Jerusalem Rd., Cohasset 02025, 383-0634

77 **Ken Meter Sales Inc.**, Box 1515, Ocala, Fla. 32670, (800) 874-0890

32 **Barber Colman Co.**, 605 Neponset St., Canton 02021, 828-6770

76 **Liberty Hazard Group**, 15 North Union St., Pawtucket, RI 02860, (401) 724-6078

43 **McDonald-Wadman Company Inc.**, 220 Reservoir, Needham 02194, 449-2500

Cogeneration systems

38 **Gibbs & Hill**, 393 Seventh Ave., New York, NY 10001, (212) 760-4000

30A **Wheelabrator Frye Inc.**, 2550 M

Continued on page 6

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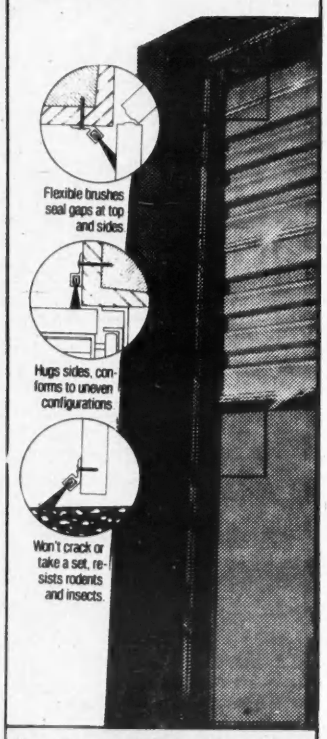
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Lancaster, Massachusetts

"The EAGLE is going to save a lot of people a lot of money."

"I'm a chimney sweep and my profession brings me into contact with a lot of wood stoves. Over the years, it is easy to determine which are doing the job and which are not - the EAGLE does the job.

As I began to run into more EAGLE installations in the field, I realized something strange was happening. People were burning green wood and there was no creosote in the chimney. Some stoves produce a lot of creosote. We service them two or three times a year. We service 30 EAGLE stoves in the field and clean only about two a year. That was enough to convince me.

The EAGLE is a new concept in wood burning. I have never seen anything like it and we make it our business to know everything there is to know about wood stoves. Now I own an EAGLE and all I burn is 4½ cords of green unsplit wood. A 12" diameter log 30" long will heat the whole house all night. It is the best stove on the market for heating a whole house - the only one that seems to do the job well."

Jim Lesperance
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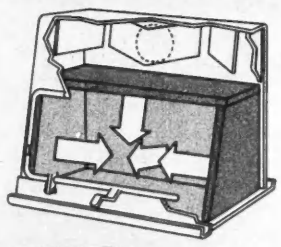
How does the EAGLE do what no ordinary wood stove can?

The secret to the EAGLE's ability to heat an entire home with any wood available is the only patented, all refractory combustion chamber on the market. Plates, cast from essentially the same materials used in ore melting ovens, interlock to form an enclosed chamber that retains heat, insulates against heat loss and remains hotter than the fire itself. The 1100°F temperature required to burn green wood and creosote causing gases is easily maintained.

The unique combustion chamber makes the EAGLE up to 50% more efficient than ordinary wood stoves and results in less creosote, ash residue and air pollution. New technology allows the EAGLE to do what no ordinary wood stove can do.

In recent years, many wood stoves have been introduced and some of them have improved on the wood stoves of fifty years ago. The airtight stove, for example, makes it possible to hold a fire all night and still have embers in the morning. In solving the problem of middle of the night loading however, the airtight stove introduced some new problems of its own.



To burn long and slow overnight, it burns fuel incompletely and inefficiently. More smoke and gases escape up the chimney because the fire isn't hot enough to consume them. Smoke and gases contain up to 50% of the BTU's available in wood. Not only is the heat lost, but the acids and gases coat pipes and chimney with creosote, creating dangerous chimney fire conditions.

The EAGLE was specifically designed to increase the advantages of heating with wood. Heat output - up to 120,000 BTU's an hour - eliminates the need for more than one unit to heat a home. The refractory combustion chamber induces temperatures that burn a log 12" in diameter so splitting is unnecessary. The high internal temperatures also greatly reduce the amount of creosote causing gases that escape up the chimney. By a happy coincidence, the same combustion chamber temperatures are sufficient to burn green, less expensive, unseasoned wood with no problem. The EAGLE's capacity offers long, overnight burn times so you wake to a warm house.

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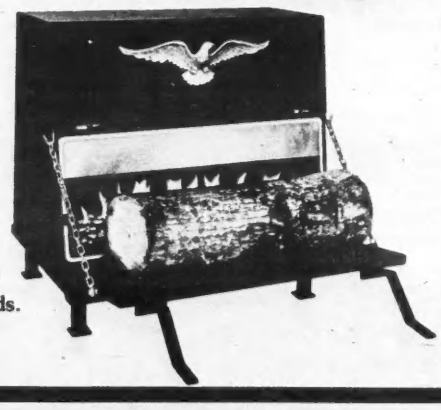

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9 **G&S Mill Inc.**, Box 75, Northboro 01532, 393-9266

2A **Resource Technology Corp.**, Pyrolytic Incinerators, 471 Hunnewell St., Needham 02194, 449-4020

Miscellaneous

132 **Nu Glaze Industries** (bathroom fixtures refinishing), 95D Cabot St., West Babylon, NY 11704, (516) 752-1666

12B **Pure Water Inc. — Pure Energy Enterprises** (water purifiers and distillers), 3725 Touzalin Ave., Lincoln, Neb. 68507, (402) 467-2577

31A **Clayton Manufacturing** (steam generators), 663 Grand Ave., Ridgefield, NJ 07657, (201) 941-4150

209 **Trade Card Exchange** (business barter exchange), 10 Post Office Square, Boston 02108, 426-3318

30A **Wheelabrator Frye Inc.** (coal liquefaction), 2550 M Street NW, Washington, DC 20037, (202) 466-6810

16A **D.M.N. Enterprises Ltd.**, Engine Efficiency Systems, Box 167, South Strafford, Vt. 05070, (802) 765-6392

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43 **McDonald-Wadman Co. Inc.**, 220 Reservoir, Needham 02194, 449-3500

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Chrysler K Car, c/o Kenyon & Eckhardt, 1 Boston Place, Boston 02108, 367-7362

124, 125 **International Energy Systems Inc.**, 240 Commercial St., Suite 400, Boston 02109, 523-1440

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National Home Improvement Council, 45 Carleton Rd., Belmont 02178, 484-2187

Union of Concerned Scientists, 1383 Massachusetts Ave., Cambridge 02138, 547-5552

Massachusetts Insulating Contractors Association, 6 Margaret Rd., Foxboro 02035, 543-5166

Boston Insulation Contractors Association, Box 321, Needham 02026, 329-2040

Wood Energy Institute, 1101 Connecticut Ave. NW, Suite 700, Washington, DC 20036, (202) 857-1181

New Resources Group, 3 Joy St., Boston 02110, 723-6477

Northeast Appropriate Technical Network, Box 548, Greenfield 01302, 774-2557

Caravan for Mass Pool Inc., 150 Causeway, Room 301, Boston 02104, 742-2655

Urban Solar Energy Association, 277 Broadway, Somerville 02145, 623-3552

Executive Office of Communities & Development, Division of Social & Economic Opportunity, 10 Tremont St., Boston 02108, 727-0050

Mass Pool Inc., 150 Causeway, Room 301, Boston 02104, 742-2655

Solar Action Week, 277 Broadway, Somerville 02145, 623-3552

Consumer seminars

(Open to the public. Each will last approximately one hour.)

Solar-energy application for the home, by Don Kent. Thursday and Friday at 3 and 8, and on Saturday at noon, 3, and 8. Sunday at 2 and 4. In the Solar Theater.

Active-solar space heating and hot water (one hour) by Gerry Keefe and Diane Bondi. Friday at 3 and 8, and on Saturday at noon, 2, and 8. Sunday at noon, 3, and 5. In Room B.

Solar-heated greenhouse principle and design, by Bruce Wilson. Saturday and Sunday at 1, in Room B.

Home and commercial heating with coal, by James Nielsen. Saturday at 3, in Room B.

Solar retrofit: adding solar to your home, by Dan Reif. Saturday at 4 and 6, in Room B.

SBA: financing your energy business, by a representative of the small business association. Saturday at 7, and on Sunday at 2, in Room B.

Trade seminars

(Open to industry and trade members only. Except as noted, each seminar will last approximately one hour.)

Installation of full thermal systems over existing wall structures, by Seymour Cohen and Jack Brennan. Thursday at 1, and on Friday at 11, in Room A.

The story of celluglass, by Edward Orminsky. Thursday at 1, in Room B.

Coal liquefaction, by Michael Kelly. Thursday at 2, in Room A.

Commercial solar systems in New England, by Warren Mackensen. Thursday at 2, in Room B.

Building retrofit for energy efficiency, by Mr. Eastman. Thursday and Friday at 3, in Room A.

Three New England cogeneration alternatives — refuse, wood, and waste heat, by John Rohrer, Wheelabrator Frye. Thursday at 3, in Room B.

Structuring an energy-conservation program for your facility, by A.W. Michael. Thursday at 4, in Room A.

Investment opportunities in cogeneration, by Peter H. Friedlander and Alec J. McAuley. Thursday at 4, in Room B.

Retrofit — commercial and industrial, by Robert Fasullo. Thursday at 5, in Room A.

Financial incentives for energy development in Massachusetts (three hours), by Ed Selgrade, director of policy and evaluation; Robert Grassi, assistant general counsel; Linda Sutliff, assistant director of renewable resources; and Paul Gilrain, assistant director and counsel for policy and evaluation. Friday at noon, in Room A.

Infrared heat-loss detection, by Herbert Berman. Friday at 4, in Room A.

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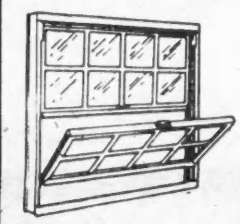

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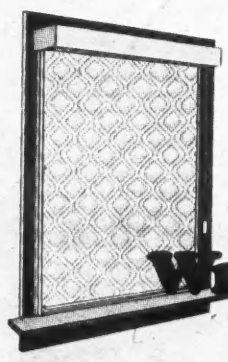

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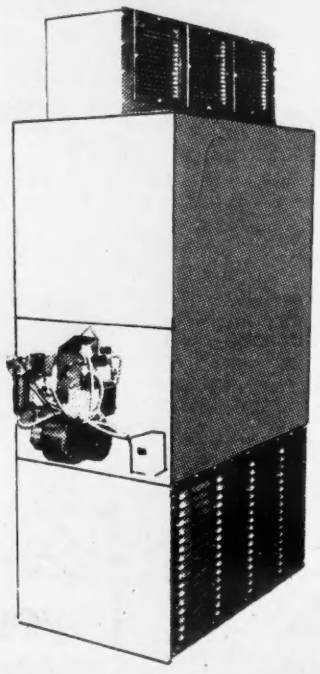

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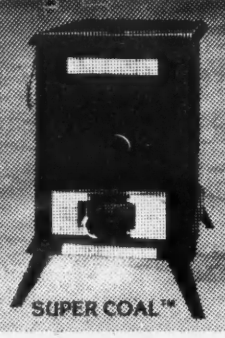

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Looking ahead to tomorrow's surprising energy options

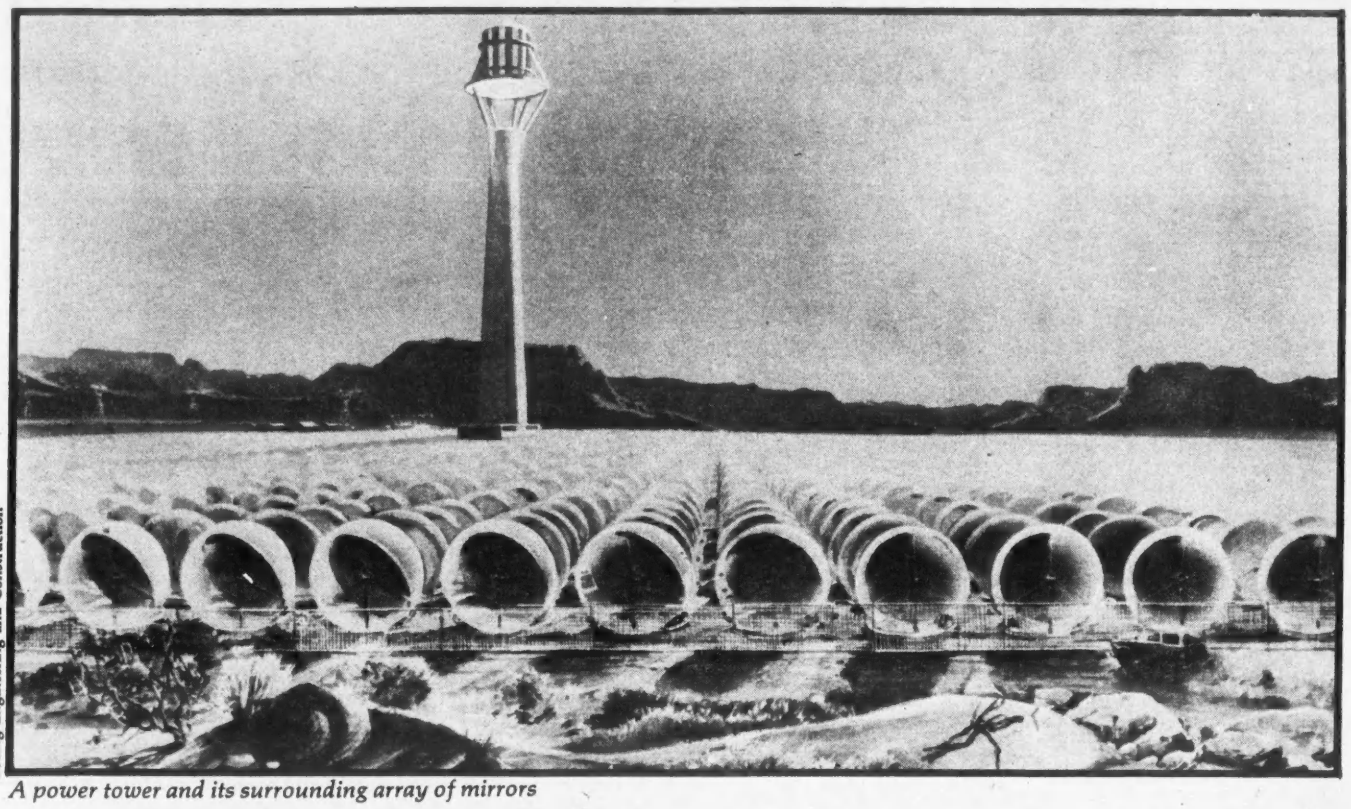
by Mark Washburn

Relax, there's no energy crisis.

There is an abundance of energy all around us, and we're in no danger of running out of it within the next five or 10 billion years. If there is a crisis, it centers on political and economic decision-making, not on energy.

In a universe that offers us more energy alternatives than Howard Johnson's has flavors, we have, until recently, been willing to settle for vanilla. But tutti-frutti and fudge-nut-ripple technologies already exist, and some brand-new flavors are on the horizon. Some of these new treats may not appeal to every palate, but that's beside the point. We are free to choose different energy technologies to satisfy the many needs and cravings of our society. We don't all have to eat vanilla.

A rapid survey of our energy options reveals an astonishing range of choices. The technology involved runs the gamut from stone-age to space-age; the hardware ranges from smaller than your fingernail to bigger than our state. Some alternatives rely on muscle and brute force, others on subtlety and wit. Some are as ominous as Darth Vader, and some are as tranquil as Yoda. But in every case, the force is with us.



Boeing Engineering and Construction

A power tower and its surrounding array of mirrors

Mark Washburn lives in Cambridge and is the author of several books. He has written a nonfiction book about the sun, which will be published next year by Harcourt Brace Jovanovich.

Our acquaintance, the atom

Many of us who grew up in the '50s remember a Disney program entitled, "Our Friend, the Atom." Our tiny buddy was pictured as safe, clean, economical, efficient, and inexhaustible, a bright new kid on the block. Well, we've knowingly lived next door to the atom for a quarter of a century now, and we've found that our neighbor has a tendency to throw trash in the street, squander money, suffer periodic breakdowns, hang out with unsavory characters, and generally scare the hell out of us. But then, nobody's perfect.

Present-day nuclear reactors split uranium atoms to liberate energy, which is then used to turn water to steam to run generators. The prime mover in this fission reaction is the neutron, which is ejected from a uranium nucleus merely to collide with the nuclei of other uranium atoms, which release more neutrons, and so on. The end product is heat and radioactive waste. Even nuclear advocates admit that this is a relatively sloppy and dangerous means of producing energy; there may be better ways of doing it.

One option is the so-called breeder reactor. Breeders will theoretically produce more fuel

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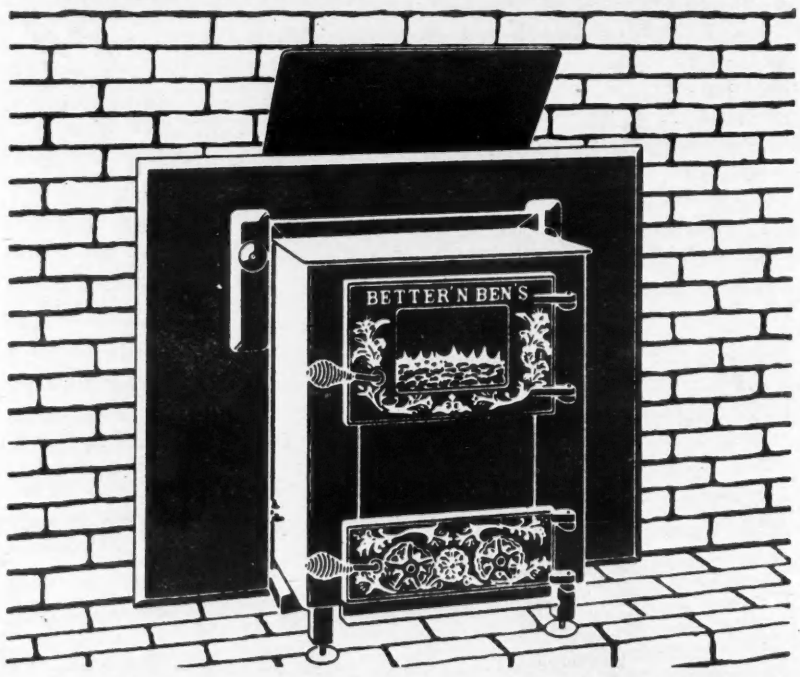

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than they consume. This is an attractive feature because we are already facing a potential uranium shortage. In breeder reactions, some of the whizzing neutrons will be captured by other nuclei, resulting in "enriched" nuclear fuel, rather than useless waste.

Breeder products, alas, are ideal for nuclear weapons. An atomic bomb can be constructed with less than five pounds of plutonium, and breeders will produce tons of the stuff. The fear of proliferation and nuclear terrorism has led even the pro-nuke Carter administration to shy away from the development of breeder reactors, which are at least a decade away from large-scale commercial use in any case. But other governments, mainly in Europe, have gone ahead with breeder development — if a terrorist wants to nuke the Pru, it will be small consolation if he does it with French plutonium rather than home-grown.

The dangers inherent in fission have caused many nuclear advocates to take the position: "You may not like fission, but you'll love fusion." Unlike fission, nuclear fusion will not create bomb material, melt-downs, or even much radioactive waste. Fusion's fuel is not uranium — one of the rarest elements — but hydrogen — the most abundant element in the universe. We can get all we need from sea water.

Fusion reactors will mimic the sun, where hydrogen atoms are literally crushed together under enormous pressure and temperature. Basically, four hydrogen nuclei combine to create a helium nucleus and energy. Fusion could be the ultimate Big Fix of our dreams, safe, cheap, and limitless.

The problem with fusion is that it does not yet exist on this planet, except in the form of hydrogen bombs. In order to maintain a fusion reaction, hydrogen nuclei must be crammed together at a density of 100 trillion per cubic centimeter, at a temperature of 100 million Celsius, for at least a full second. So far, none of these criteria has been met.

Two basic strategies for producing the required temperatures and pressures are being pursued. In one, hydrogen is condensed and contained by intense magnetic fields. In the other, millimeter-sized pellets of heavy hydrogen (deuterium) are zapped to infinity by megavolt lasers. Both methods have shown promise, but neither has yet produced more energy than it consumes. Optimists expect that the first controlled fusion reaction may be achieved as early as 1985. Demonstration reactors could be in operation by the late '90s, but we will be well into the 21st century by the time commercial fusion is a reality — if, indeed, it ever is. In addition to being damned difficult to achieve, fusion is also incredibly expensive, and some analysts doubt that it can be made economically attractive within the foreseeable future.

Here comes the sun (and it's more or less all right)

Fusion is hard to achieve here on earth, but the sun has been doing it for four-and-a-half billion years — and for free. In two weeks, the sun imparts more energy to the earth than is stored in all the fossil-fuel reserves on the planet. Those fossil fuels, incidentally, are simply solar energy that has been stored in the ground for 100 million years or so. Rather than a fuel of the future, solar energy is also a fuel of the past and present. Hydroelectric power is, in a way, solar, as are the wind, the ocean currents, and ultimately even gasoline.

Until modern society was corrupted by cheap oil, solar energy in one form or another was civilization's primary power source — and it can be again. Lately, in fact, just about everyone has been extolling the virtues of solar energy. It's an apple-pie-and-motherhood energy alternative. Though everyone's for it, everyone has his own idea of what solar energy is.

For the "small is beautiful" crowd, solar energy means rooftop collectors, back-yard windmills, photovoltaic panels, and a good tan. It also means, in the bargain, a step toward the further democratization of society. A "small-solar" society would be independent of the whims and machinations of Arabs and Exxon executives. As the adage goes, you can't put a meter on the sun.

Nevertheless, oil companies and utilities are trying to do just about that. An alternative to the laid-back small-solar society is the business-as-usual Big Solar scenario. In a Big Solar society, the sun would in effect be owned by the same people who already own the coal, oil, and uranium.

Direct use of the sun's energy eliminates the middleman, allowing the consumer to get his power directly from the producer. The middlemen — the energy companies — are less than overjoyed at this prospect. They have consistently minimized the potential of solar energy, portraying it as a marginal power source for the distant future. A pamphlet published by the Edison Electric Institute, for instance, warns: "Any crash effort to return to the sun as our primary source of energy could be accomplished only through a sharp reduction in our standard of living."

On the other hand, the energy companies have begun to move into solar-energy development, if only to ensure that, whatever use is made of the sun, they will get their slice of the pie. In the Big Solar game plan, we will all still buy our energy from centralized producers.

The epitome of Big Solar is the power tower. In this scheme, huge mirrors are set up in an array covering several square miles. The mirrors reflect the solar energy and focus it on a tank of water at the top of a tower in the middle of the mirror array. The water boils, turbines spin, and the lights go on. There is already a functioning power tower in France, and the major American effort, the Barstow (California) Power Tower, is due to begin operation in the near future.

But power towers are expensive (more than $75 million for the Barstow tower), and they require a lot of land. That's not a problem in Barstow, but don't expect to see any power towers in Somerville.

Despite all the money that has been spent on Big Solar projects, small-solar is alive and well. A recent study by Cal Tech's Jet Propulsion Laboratory, in Pasadena, indicates that simple rooftop photovoltaic panels, which produce electricity directly from sunlight, can more than meet the projected increase in demand for power over the next 35 years. According to the JPL study, we don't really need to build Big Solar projects, or even augment our existing conventional power plants. Indeed, photovoltaics can turn some local districts into exporters of electricity.

The problem with photovoltaics is cost. For most uses, they are still more expensive than oil, gas, and nuclear. But that situation is changing so rapidly that photovoltaics may well become competitive within the next few years. Oil prices are still rising, but the cost of solar photovoltaic cells is plummeting. Last year, the Stanford Research Institute announced the development of a new system for processing silicon (the basic ingredient of photovoltaics) that cuts the cost by a factor of 10. And just a few weeks ago, Crystal Systems Inc., of Salem, reported a breakthrough in the cost of manufacturing blank silicon wafers, resulting in another (parallel) factor-of-10 reduction. These cost-slashing discoveries are becoming the rule, rather than the exception.

One costly step in producing photovoltaic cells is the processing of pure silicon. A proposed solution is that the cells should be manufactured in space, where zero gravity would allow the production of silicon of truly unearthly purity. However, the cost of shooting the stuff into space and bringing it back down is likely to be prohibitive. So why not just leave it there?

Beam it down, Scotty

The biggest of the Big Solar projects is the Solar Power Satellite (SPS) system. This gargantuan enterprise involves the construction of a fleet of 60 orbiting photovoltaic arrays, each as large as a mile across, which would collect enough energy directly from the sun to meet all our power needs. The solar energy would then be converted to microwaves and beamed down to receiving antennas — also enormous — on the ground.

The SPS concept is the brainchild of Dr. Peter Glaser of Arthur D. Little Inc., in Cambridge. When he first proposed it, in 1969, almost no one took it seriously. But gradually, SPS has emerged as a feasible alternative, and the government has spent more than $20 million researching it. So far, no one has come up with any sound scientific or technological reasons why it cannot be done.

Continued on page 18

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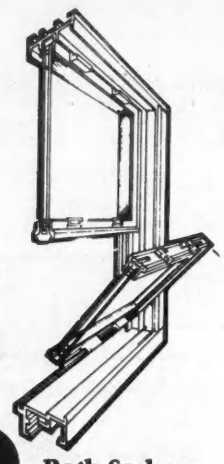

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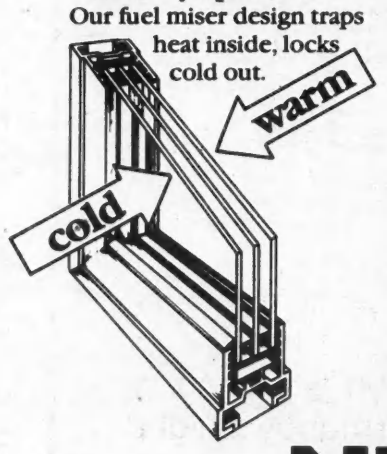

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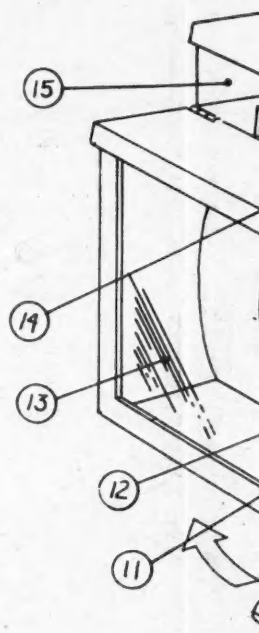

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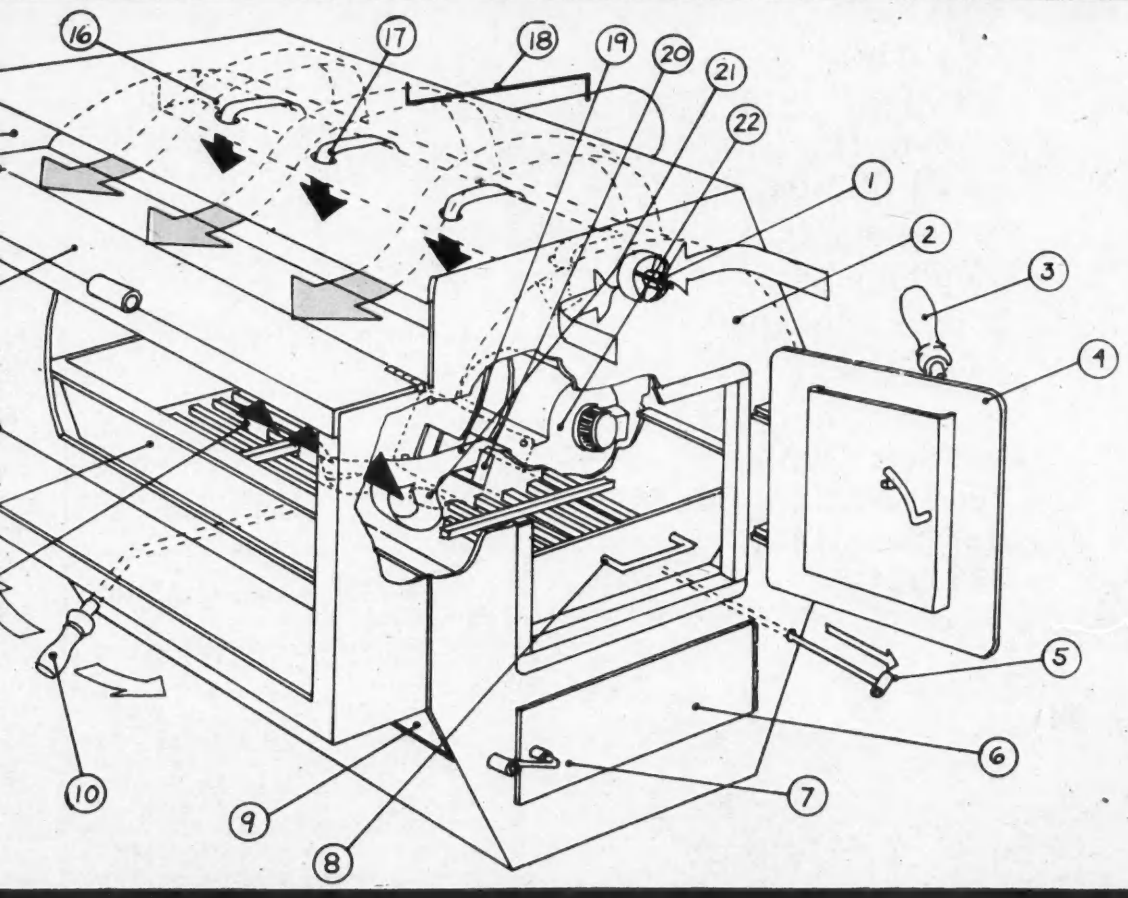

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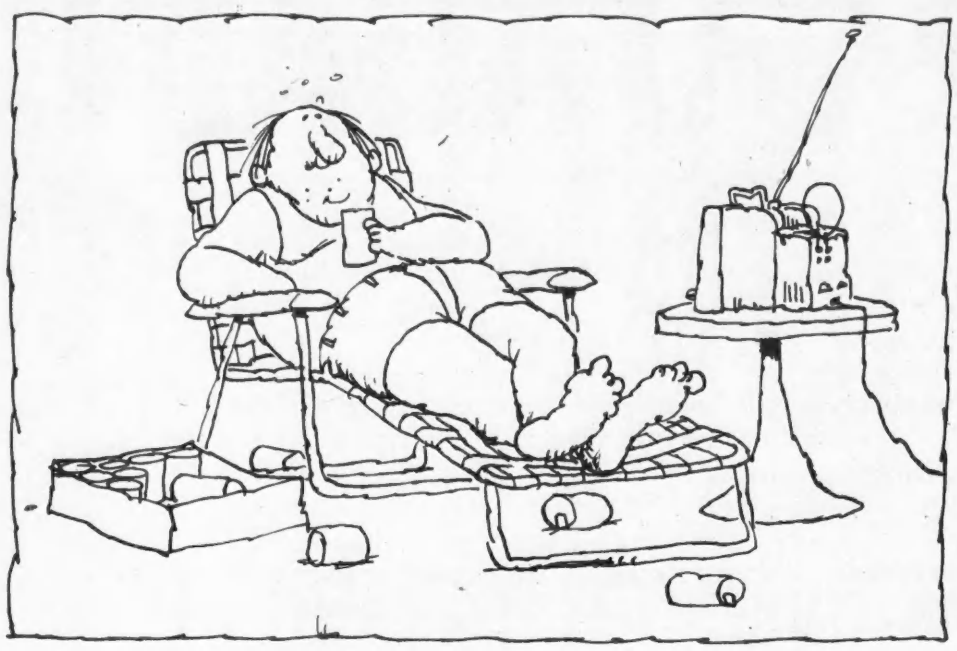
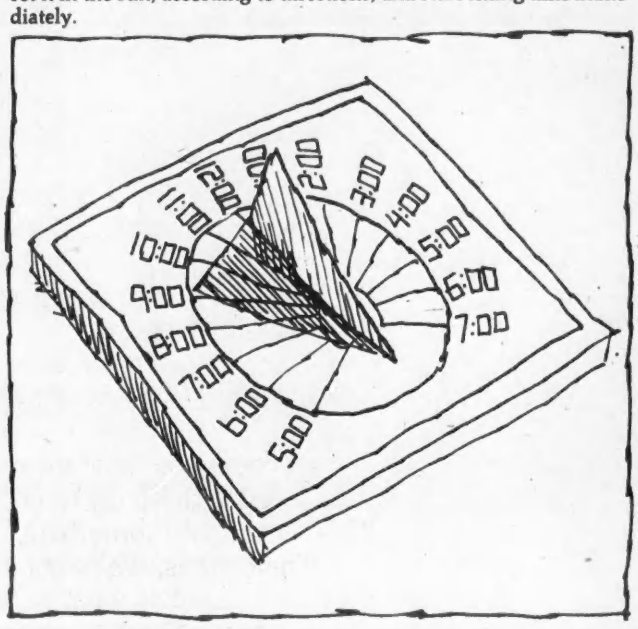
by Jim Carson



Solar-powered beer disposal. Contents: one (1) lawn chair, and one (1) television. Set the chair, the TV (tuned to the ballgame), and a six-pack in the back yard on a sunny afternoon. Set a husband in the chair and go away. When you return at the end of the afternoon, the beer will have disappeared. Results will vary, but some users have reported disposing of an entire *case* of beer in less than two hours. (Note: unfortunately this is not the beer disposal endorsed by leading temperance groups.)

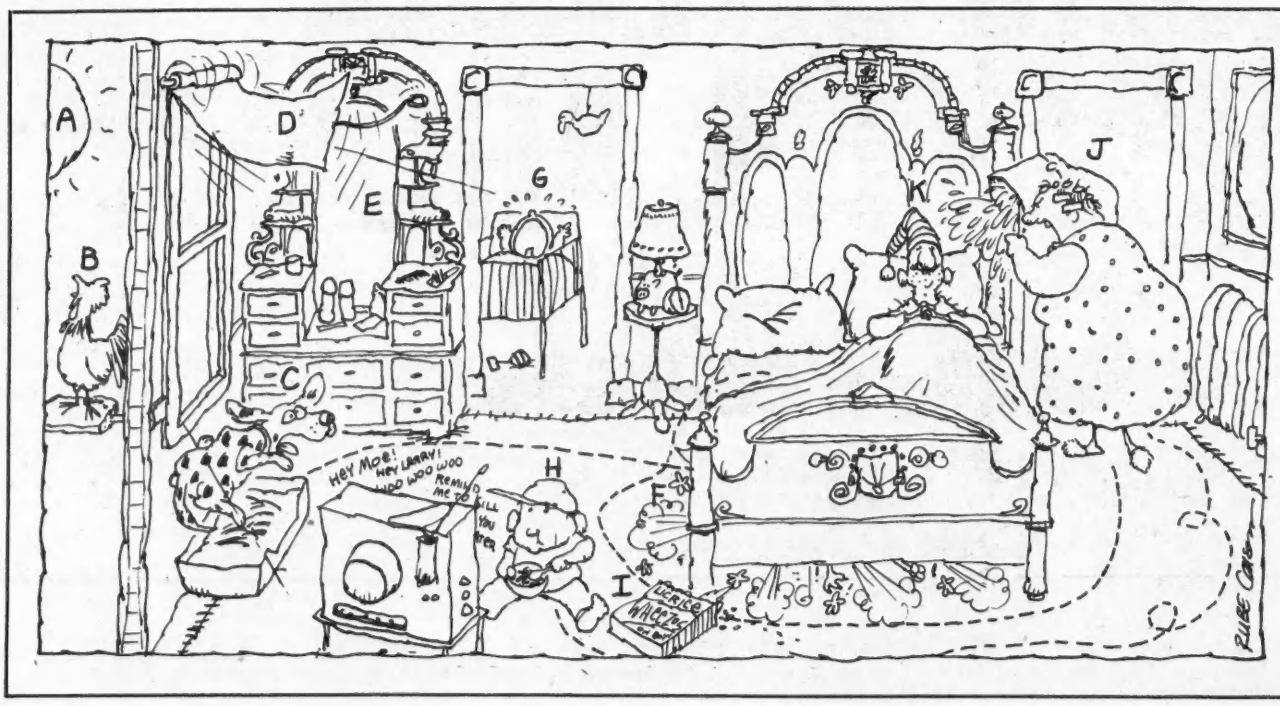
Solar-powered digital clock. The manufacturer claims that the sun keeps amazingly accurate time. Better time, even, than most man-made timepieces (though the sun won't work strapped to a boat propeller like a Timex will). Comes in chrome or smoked Plexiglas. Just set it in the sun, according to directions, and start telling time immediately.



Solar-powered mouse trap. Contents: one (1) recycled lighthouse lens mounted on a stand. Mice are attracted to cheese hanging in front of the huge magnifying lens and then are temporarily blinded by the glaring light. At this point you can cut off their tails with a carving knife or waste them or whatever. This trap will only work until the mice develop an immunity, such as sunglasses.

Solar-powered cigarette lighter. Why flick your Bic when you can tap into the limitless power of the sun? Just clip this handy lighter to cigarette, cigar, pipe, etc., and puff away. Take that, OPEC!

Solar-powered hot-water bottle. The bottle is clear plastic with a black-painted bottom that soaks up the sun's rays. Just fill it with water, put it on your head, and sit out in the sun until it gets hot or you faint. Either way you forget about your headache.



Solar-powered extra-strength wake-up alarm system. Contents: one (1) rooster. (If you do not already have them, other system components are available at local animal shelters, hardware and grocery stores, orphanages, and singles bars.) Rising sun (A) sets off rooster (B), which scares skittish hound dog (C), which jumps up and runs under the bed, releasing window shade (D), which fills the room with glaring light (E). Dog becomes embroiled in a life-and-death struggle with cat (F), which was sleeping under the bed, and the resultant din wakes up the baby (G), who starts to howl and wakes up older sibling (H), who noisily gets a bowl of "Licrice Wheezos" (I), and starts watching the *Three Stooges* at full volume. This wakes up wife (J), who gets out of bed and shouts encouragements as she dumps cold water on hubby (K), since he has managed to sleep through all this racket.

HERE WE GO AGAIN!

A while ago, we told you some things about natural gas you may not have wanted to hear. And we'd like you to know why.

Because everybody was talking about the problems this country was having with oil. But nobody was saying anything about the problems with gas.

That seemed to us to be very unfair. And that's why we brought up the whole subject.

Of course some of the more skeptical responded with "They're in trouble. They have to do something."

The truth is, we're not in trouble. At least, not based on what we've heard. One gas company official has revealed that 79% of the people they had scheduled to convert to gas called up to cancel after learning the facts.

So why are we back here again?

Because some things have changed since then. And we think you ought to know about them.

For one thing, we've found that this country is becoming increasingly reliant on Liquefied Natural Gas (this last year, imports are up 200%).

Worse, we're depending on Algeria for most of the LNG we're importing. And during this year, they've been trying to jack up the price of LNG so it will cost 60% more than oil.

For another thing, we've discovered that some people are converting to gas by sticking a gas burner in a furnace that burns oil. And that's a bad idea. Because a gas burner isn't designed to work in an oil furnace. The flame is too small. And it doesn't radiate heat like an oil flame. So instead of saving money, people are wasting a lot of gas.

You'll be seeing and hearing more about these things in the next few weeks.

You may not like what you see and hear. But you should pay attention.

It's for your own good.

THE MORE YOU KNOW ABOUT GAS, THE MORE COMFORTABLE YOU'LL FEEL ABOUT OIL HEAT.

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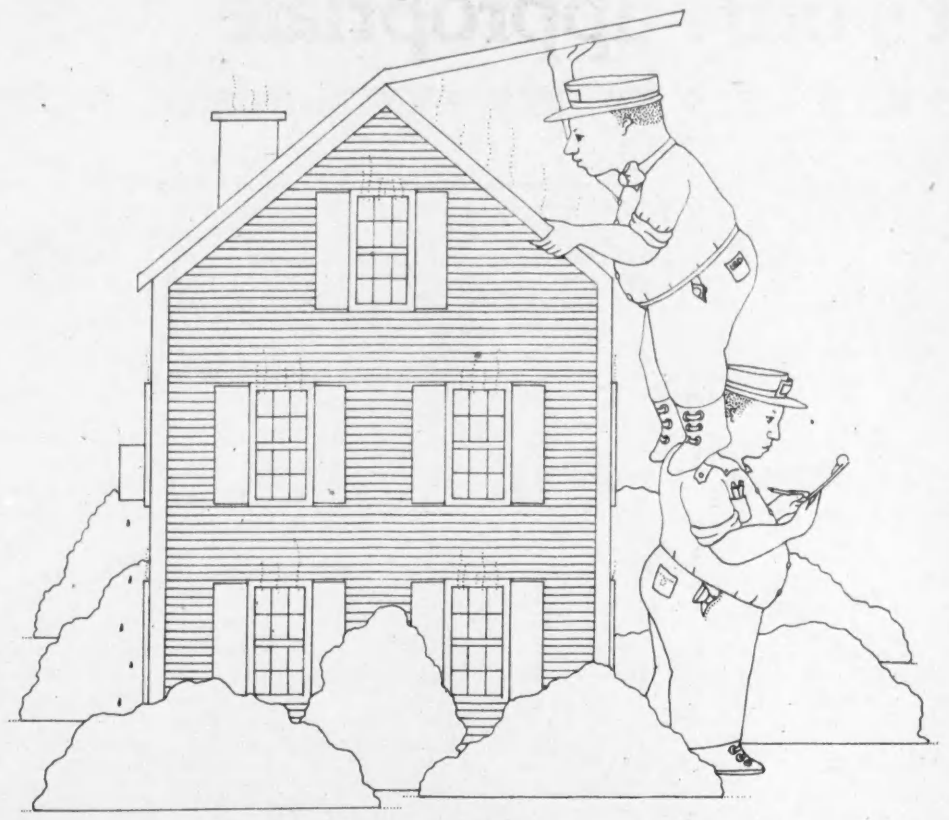
Learning home economics

Utility companies enter the home-energy-audit field

by Renee Loth



Lucy Dillon

With remarkable speed for a usually sluggish bureaucracy, the US Department of Energy is moving to make energy auditors as familiar in American homes as TV repairmen and plumbers. Beginning during the coming heating season, before January, 1981, all major gas and electric utility companies must be ready to perform "heat loss analyses" for their customers at rates well below those charged by commercial auditors. With cooperation from state governments and a mandatory public-education campaign, the feds hope to have us living in snugger, cozier, more efficient homes by the end of the decade.

Home energy audits first entered the lexicon three or four years ago when federally funded CETA workers were trained to evaluate the energy efficiency of homes whose low-income residents were in fuel-assistance programs. The audits soon became popular with middle-class homeowners and major property owners, who had more to gain from investing in energy-saving home improvements. By last winter the *Yellow Pages* were full of "energy-conservation consultants," who made a living looking for energy leaks — and then contracting to plug the leaks with their own handy insulation or aluminum siding. As Bill Moriarty of Energyworks, in Newton, puts it, "No one makes money on just the audits."

The new federal regulations — pulled together in what is called the Residential Conservation Service (RCS) Program — require your utility company to encourage conservation by auditing your home for just $10 or $15 and then recommending various energy-saving measures, from caulking loose windows to fully insulating floors and attics. The utility companies must also tell you about financing plans, lending institutions, and tax credits and rebates, and must point you in the direction of a federally approved contractor who will do whatever work you choose for a quoted fee. The utility's auditors must demonstrate to you low-cost or no-cost energy practices such as opening drapes on sunny days, must provide estimates of the cost for the work they suggest and of the energy savings you should realize, and must project a "pay-back period," or the time by which you will have earned back your investment in new storm doors or insulation through lower heating bills. In addition, the law requires the utility to advertise that the audits are available (in both English and Spanish), follow up on the quality of the contractors' work, and mediate consumer complaints.

This all amounts to a big headache for your friendly electric or gas company, and most Massachusetts utilities are looking around for established auditing firms to help them comply with the law rather than training or hiring employees. Energyworks, for example, is negotiating with the state's utilities to perform federally mandated audits at the customer's request. Happily for Energyworks, there is nothing in the state RCS program that prohibits the auditing firm from contracting for the home-improvement work as well.

This "double dipping" factor in the RCS program is not the only bug in the works. Many consumers see an inherent contradiction in asking their electric company to suggest ways to use less electricity. They are, to say the least, skeptical. Bill Smith of the Energy Education Center at UMass-Amherst, which developed a training manual and a model audit for the RCS program, says a pilot program in New York state last year elicited a mere three percent response rate for utility-sponsored audits. "People just don't trust the utilities," he says.

The small, independent auditing firms are banking on this to keep them in business. But the average customer will end up losing money if he or she doesn't take advantage of the utility audit, since the utilities' costs for running the RCS program can be passed on in the rate base — a sort of "audit adjustment charge" on the monthly bill. Much of a home energy audit is common sense, and many necessary measurements can be taken unscientifically by residents, who can figure out what they mean from reading magazine articles. But since you are paying the lion's share of what the audits cost anyway, you may as well take the company up on its offer.

A further problem with the RCS program is that, while the Massachusetts version of it was amended to include dwellings of

Continued on page 16

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It's only appropriate

Federal funds for new energy-related technology

by Howard Litwak

You might think "Appropriate Technology" sounds like a chapter in one of E. F. Schumacher's books. You wouldn't be far wrong. Appropriate Technology is a program through which "small is beautiful" has filtered its way into no less a presence than the US Department of Energy (DOE). Consider:

— Action for Boston Community Development (ABCD) recently installed its first solar-assisted space-heating device on a residence in Mattapan. The first solar panel specifically designed to be easy and cheap to build, this prototype was built by CETA labor.

— The Association for Public Transportation, located in Boston, will shortly be testing a curriculum and course book designed to teach fourth- and fifth-graders how to use public transit.

— The Coolidge Center for the Advancement of Agriculture, in Topsfield, recently conducted a successful one-year test of a mobile, modular greenhouse system that uses "Dutch lights" and is particularly suitable for small-scale farming.

These are three of 73 projects funded in New England in 1979 by DOE's Appropriate Technology Small Grants Program. The program summary admits: "These projects, when viewed with a limited scope, constitute a negligible fraction of the energy-related research and development taking place in our country today." But, it adds, "when viewed with an eye toward local control and renewable resources, these projects demonstrate an impact far beyond the initial work. Virtually every project funded has an education or demonstration aspect; local people will learn from local projects."

Appropriate Technology, says regional Program Manager Bob Chase, is designed for those "who are looking at alternative methods of energy use that we aren't now aware of, things like solar, wind, water, and conservation. It's primarily to help inventors and small groups." It is windmills and solar panels, greenhouses and peat, cold storage by snow, and small-scale hydroelectric projects; what constitutes "appropriate technology" is left extremely flexible in the program regulations. For instance, according to the *Federal Register*, one critique of the original regulations suggested "excluding from program funding all projects using photovoltaic technology because it is not an 'appropriate technology' for the purposes of this program." The DOE's response was that the choice of how to define "appropriate technology" should "remain at the regional level and that it would not be proper to exclude a particular technology from funding."

Appropriate Technology was authorized by the Energy Research and Development Administration Appropriation Authorization of 1977. In 1978, a successful pilot program was instituted in California. Last year was the program's first on a national scale, and for a new program, Appropriate Technology isn't very big. In 1979, it gave away only $12 million nationally, and just $800,000 of that went to New England (called Region One for program purposes).

To inaugurate Appropriate Technology, DOE sent out "request for proposal" flyers (a common practice in federal grants programs). It received, in Region One, 1450 proposals. Says Michael McClintock, who runs a small, solar-related business and who was a successful applicant, "I get a lot of these, but this one seemed to make a lot of sense, so I went ahead and applied." Indeed, at least among the successful applicants, it's difficult to find anyone who says anything harsh about the program. Eliot Coleman, director of the Coolidge Center, says, "I think the program's great, although I think it gets taken advantage of. A lot of applicants are Joe Homeowner trying to con Uncle Sam for a solar-heated house. But I think the ones that get granted are first-rate."

Even the grant application seems spritelier than most government forms. Garlanded with a quote from *Gulliver's Travels*, it is direct and, according to the successful applicants with whom I spoke, easy-to-follow. "If you're used to most federal programs, where you have to file 85 copies, this is really nice," says one.

Appropriate Technology grants can be applied for by individuals, nonprofit organizations, state and local agencies, Indian tribes, and small businesses (those with fewer than 100 employees). Grants fall into three areas: idea development (for a maximum of $10,000), device development ($50,000 maximum, and demonstration ($50,000 maximum). These limits cause some problems. McClintock, for example, wanted to research a new solar-energy device, a multi-mode solar collector. The idea was that the collector could generate both electricity and heat. McClintock sought about $20,000; he received $14,000. "I was much too optimistic in terms of time and money, which is not too wise an assumption when you're engaged in research," he says. McClintock wasn't contacted to revise his budget. He was offered the $14,000, take it or leave it. He took. "I do have serious second thoughts about accepting government funding for research of this kind," he now says. "It's underfunded. The Appropriate Technology people themselves have limited budgets. I never found them anything but helpful. It's just that the larger companies have the resources to do this kind of research better than small ones." McClintock is particularly dismayed that the level of funding made it impossible for him to research his idea sufficiently even to determine whether it was worth pursuing further. "It's just another good idea languishing for lack of funds."

On the other hand, for many of the projects that Appropriate Technology funds, the grant provides all the money needed. The Coolidge Center, for example, received $10,700 to build its Dutch Light Greenhouse system. The original Dutch light was developed early in the 20th century in Holland, an agriculturally intensive country. It is

Continued on page 16

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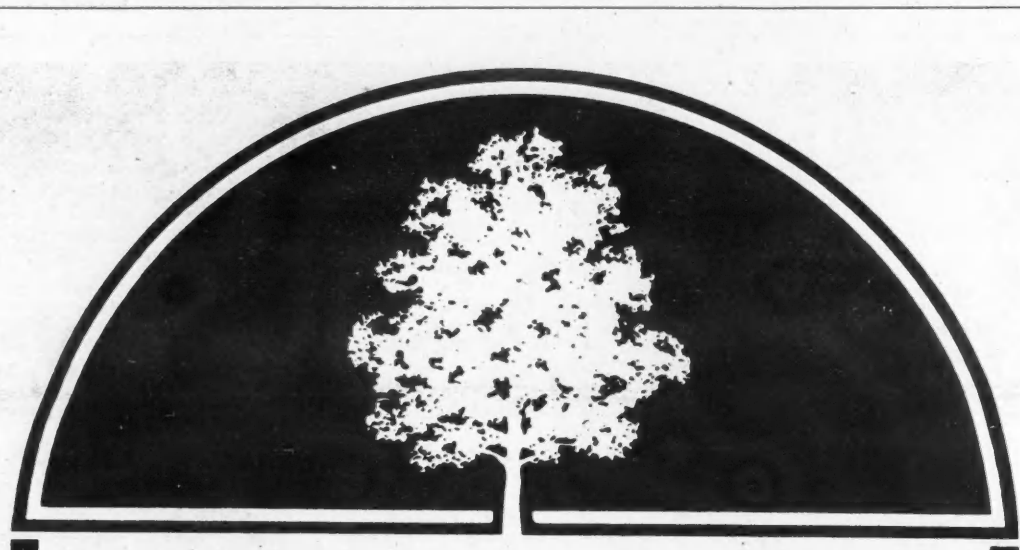

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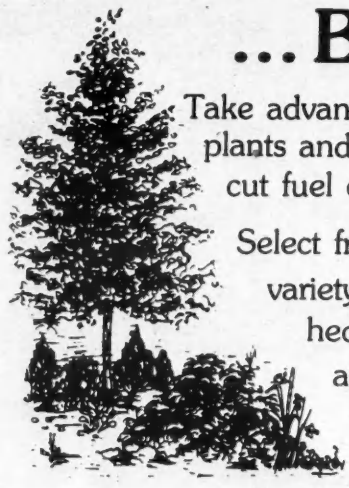

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Continued from page 15

constructed of wood frames and two-foot-by-five-foot pieces of glass. The concept, as explained to the Energy Department, was "to construct and operate a low-cost, one-year-payback system for growing out-of-season produce." Says Coleman, "We can grow a majority of salad and root vegetables 10 months a year in Topsfield." The advantage of the system, according to Coleman, is that, since it's movable, it can be taken to the crop that needs covering, when it needs covering. The Center is now preparing a booklet explaining to home handypeople how to build the system. It also takes around a slide presentation to interested groups and will soon be conducting Dutch-light workshops.

The figures for Appropriate Technology last year make for interesting reading. As noted, only 73 proposals were funded out of 1450 proposals from New England. This percentage of acceptance is lower than that of most prestigious medical schools. **Massachusetts had the most — 20 — grants funded (out of 607 proposals, Rhode Island had the highest percentage of applicants funded (just under 13%), and every state in the region had at least eight grants funded. This was not unintentional. The program's regulations (which have been revised somewhat since last year) allocate funds according to a formula: two-thirds of a region's money must be allocated according to population, while the remaining one-third must be allocated by number of proposals received. Each state must receive at least 1.6 percent of the total regional funds (last year the minimum was slightly over four percent).**

The program also aims for balance in the types of proposals it funds. Inevitably, given the current thinking in the energy field, solar proposals dominate (they made 29 percent of all Region One applications). Nonetheless, grants were funded in 12 different areas, including conservation, education, and even "ice, snow & peat."

Appropriate Technology proposals go through a four-stage review process. First, one of the three-member staff reviews each proposal to make sure that it has been properly filled out. The applications are then read by several experts in the field. (So small is the field that last year's grant recipient is this year's reader.) This "technical evaluation" considers whether the proposal is technically and financially feasible as its stands. The proposals are then passed on to a State Review Board, which evaluates them according to 10 different criteria, including "expected energy savings and production," "likelihood of commercialization or utilization of the proposal," and "adequacy of the business aspects of the proposal." The size of the board varies from state to state within Region One, but generally is from three to six. All serve without remuneration. Finally, a DOE selection board (consisting, in Region One, of DOE people in finance, programing, and regulation; a representative of the Small Business Administration; and several others) select the proposals for funding based on both the ranking the state boards have given to proposals and a four-point consideration: 1) regional distribution, including geography, population, and climate; 2) project type distribution; 3) diversity of participants; and 4) best overall use of the funds.

Some of the projects seem a little odd for federal money to be funding. Tekton Industries, a small business in Conway, imports a machine from Germany that makes wood briquettes from sawdust. These briquettes can be used as fuel anywhere one would use wood. **Tekton received $40,000** to manufacture and distribute, in 10-to-15-pound bags, 100 tons of briquettes. The company's initial step was to learn about briquette use (through a questionnaire) and briquette manufacture (through experience). Tekton learned a great deal: that consumers like the size of its bags; that it's important to use high-quality sawdust; that winter is a bad time to manufacture briquettes because then there is very little extra sawdust; that if sawmills installed the briquette-making machines that Tekton imports, they could certainly make briquettes that could be priced competitively with cord wood. This is obviously information of value. Still, it does seem questionable that a small business that seeks to profit from the briquette-making machine is allowed to receive a grant studying the economic feasibility of the machine's product. Such considerations will inevitably arise as long as grants are awarded to profit-making organizations.

But most of the grants represent a surprisingly selfless approach. The Association for Public Transportation (APT), for example, made the argument that encouraging the use of public transit saves energy that would be used to power private automobiles. It received its grant by pointing out that when children grow up being chauffeured by their parents to everywhere they want to go, they don't learn the public transit system. The curriculum APT is developing is **intended to be a useful geography lesson (learning to get** around Boston or to read a bus-route map is far more useful than is memorizing Central American capitals, as most of us did in grade-school geography) as well as a means of teaching children what is involved in public transit. (Now if someone could only teach the T the same thing . . . .)

ABCD's project, the solar-assisted space-heating device (SASH), is designed so that the home handyperson or, rather, neighborhood groups of handypeople can obtain instructional pamphlets and build the systems themselves. The materials involved are cheap and easy to obtain. ABCD calculates that, exclusive of labor, SASH costs $3.10 a square foot to build. Since ABCD also calculates that each square foot of the system can save one gallon of heating oil per year, the system should pay for itself in four years or less. (Of course, this has yet to be proven. The Thomases of Mattapan, on whose southern exposure the first SASH was installed, say that it isn't even completely hooked up yet.)

Meanwhile, ABCD is forging forward with new projects, which is what appropriate technology — and the Appropriate Technology program — is really all about. ●

Audits

Continued from page 14

more than four units, the audit program doesn't go very far to help tenants with their energy costs. Most of the federal and state tax credits and low-interest loan set-ups apply only to homeowners and landlords, and while utility auditors will visit a single apartment in a large building at the tenant's request and perform energy evaluations without a landlord's approval, most measures available to apartment dwellers will result in small savings at best. Using a humidifier during the winter, making sure your radiators are not blocked by drapes or furniture, keeping the fireplace damper shut, and closing off rooms not in use are not exactly revelations to the hard-pressed Boston tenant. But doing the legwork for your landlord and supplying him with payback period charts and financing options may prompt him to proceed with the more extensive energy improvements, even though he is generally not the one paying for your heat. Anyway, it's worth a try.

What exactly will this agent of the utility *do* when he enters your humble abode? In the "Class A" audits required by the law, the auditor must look at your fuel bills, check the "envelope" of your home's doors, windows, attic, and basement to see how well it retains heat, and determine your existing conservation measures by talking to you about your energy "habits." (He won't get too personal.) If you answer "yes" to the following questions, you're probably already doing as well as can be expected on your energy costs:

Do you turn off lights when leaving a room?

Have you installed energy-saving dimmer switches?

Is your air conditioner on the north side of the house and in the shade? (Extra points for not having an air conditioner.)

Do you shower rather than bathe?

Do you change or clean your heating filters every month?

And like that. Next, the auditor will test your furnace and provide you with a list of financing plans to mull over while the utility computer decides how much energy (and money) you can save by

Continued on page 18

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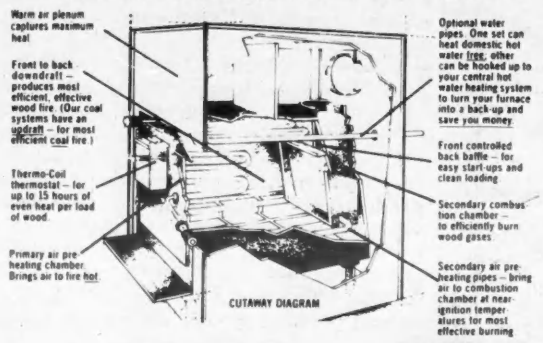
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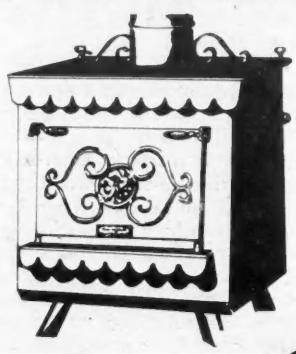

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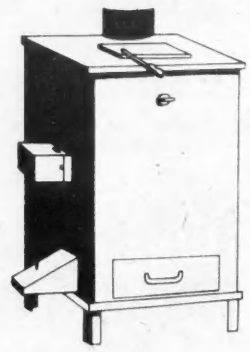

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Audits

Continued from page 16

contracting for various repairs suggested, how much they will cost you, and when you'll break even on your investments. Finally, in Massachusetts the auditor must actually demonstrate how to caulk windows (does the stuff go on the inside or the outside of the windowsill?) and perform other low-cost, do-it-yourself energy-saving tasks. Marilyn Rolind, who coordinates the RCS program for the Massachusetts Office of Energy Resources, fondly refers to this state's model as "an A-plus audit because of the demonstration factor."

Both the state and the federal laws will probably have the effect of injecting a little quality control into the auditing field. Currently, there are no standardized tests for certification of auditors and no standards for what constitutes an audit in the first place. "People were calling infrared pictures an audit," says Kitty Cox, formerly with the Massachusetts energy office and now with Energyworks. The RCS program, however, details very specific requirements for participating auditors, including attending a three-week training program and quarterly "booster" workshops. And the UMass model audit covers many bases, including evaluations for solar and wind systems, which one wouldn't normally expect an electric or gas company to promote.

The RCS program still has plenty of competition in the auditing industry, and alternative evaluations should be available for some time. Besides the private firms, Boston's Office for Housing will continue to provide free audits to the city's homeowners and landlords, at least, according to planning director Karen Sunnarbort, "until the RCS program gets off the ground." Another benefit of living in the city is the Office for Housing's rebate program, which pays back 20 percent of the cost of home improvements that are energy-related, or 40 percent to low-income residents and landlords improving their tenants' dwellings. Residents wishing to be eligible for the rebate program must receive an audit from one of the city's "rehabilitation specialists." The 13 neighborhood-site offices of the Office for Housing have details.

And then, the state and federal governments provide tax incentives for energy-conscious homeowners. According to Kitty Cox, a Massachusetts resident may deduct up to $300 on his state income-tax form to cover up to 15 percent of an energy-related home improvement. Marilyn Rolind says a tax credit of up to $1000 is available for any energy-conservation purchase except a wood stove. This includes solar- and wind-powered energy systems, for which you can recover another 45 percent of your costs through your federal tax return.

Short of its educational value, an energy audit *per se* brings you no benefits. But experience indicates that most homeowners who have audits performed contract for at least some of the suggested improvements — and realize substantial savings after having them done. Last year Massachusetts Fair Share, the citizens' group, sponsored a home energy-audit program, with a private firm in Cambridge, the Energy Bank, performing the audits. Twenty-four hundred Fair Share members and other residents of greater Boston had audits performed on their homes, and 80 percent of those followed through with at least some repairs. Fair Share estimates that their members saved an average of 40 percent on their fuel bills after making investments in their homes averaging $1500. This translates to a per-home saving of some 480 gallons of home heating fuel over the winter, which "pays back" a $1500 investment in about three years. Fair Share will offer the same program again this year, for $45 per audit (call 266-3009 for more details).

Bill Smith at UMass-Amherst says the state-funded Energy Conservation Action Project (ECAP), one of the first organizations to perform home audits in Massachusetts, gathered similar pay-back statistics. Most of the 8000 homeowners who participated in ECAP, he says, realized up to 40 percent savings on their fuel bills. For tenants, Smith says, "we could at least suggest ways to make things more comfortable."

There's no time like the present to have an audit performed on your home. Marilyn Rolind cautions that fall is always the busiest season, though, and customers who wait until next spring to try the utility audits will probably benefit from having given the program a chance to work out its early kinks. Already the energy office is trying to address some of the complaints against the federal utility mandate. In some parts of the state, utilities will likely join with each other in consortiums to hire large firms such as Boeing or General Electric, and these will put some perhaps welcome distance between your gas or electric company and its recommendations for your energy use. Of course, that just brings up the question of whether customers who distrust their utility companies will like Boeing or General Electric any better. ●

Tomorrow

Continued from page 9

But whether it *should* be done is another question. The entire SPS system would cost about a *trillion* dollars — roughly the cost of 20 Apollo projects or eight Vietnam Wars. Militarily speaking, it doesn't seem like a good idea to have our entire power supply up in the sky like a space-age shooting gallery. Economically speaking, the pay-back period would be decades or even centuries. And environmentally speaking, while it may be desirable to get messy energy production off the earth entirely, the microwaves needed to get the energy back down may be dangerous to living organisms. Besides, the 60-satellite game plan would require receivers to be spead over more than 2000 square miles — an area the size of Delaware.

The green machine

One of the ironies in our attempts to get energy from the sun is that green plants have been doing it successfully for about three billion years. Through the miracle of photosynthesis, plants convert sunlight into stored chemical energy in the form of sugars. Virtual armies of scientists are now attempting to duplicate this neat trick, and the latest word is that we may be very close to achieving synthetic photosynthesis.

In plants, incoming solar radiation liberates electrons and drives them across a photosynthetic membrane, where they participate in chemical reactions that create sugar and free oxygen. The reaction splits water molecules, liberating the oxygen and binding the hydrogen to sugar molecules. In synthetic photosynthesis, the hydrogen would be tied to free hydrogen ions, resulting in the production of hydrogen gas, which is an excellent fuel. According to one scientist, when we learn how to do all of this efficiently, "the world's energy problems will be solved . . . and we're close to home now."

The problem is being attacked from a number of directions. One approach involves imitating the natural processes in plants via a series of ersatz photosynthetic membranes. Other methods concentrate on duplicating each of the individual steps in the photosynthetic reaction and then combining them in the most efficient way. Another approach is to ignore nature and simply invent new methods of using sunlight to split water molecules. Rapid progress is being made on each front, and it is too soon to say which approach will achieve the greatest success.

Once we have hydrogen from plants, there may be problems in getting people to use it. Hydrogen suffers from severe public-relations problems: people still remember the *Hindenburg*. Hydrogen is highly flammable, and it is very difficult to store. There are a few hydrogen-powered automobiles and various demonstration projects around, but our general hydrogen-fuel technology is not highly developed. Thus, there may well be a gap between our ability to produce hydrogen and our ability to use it.

However, hydrogen is only one of the fuels that can be exported, as it were, from the plant kingdom. Gasohol — a one-to-10 mix of ethanol, which of course comes from plants, and gasoline — is now available at over 2000 service stations in the United States. It is gaining in popularity here, but we still lag far behind Brazil, where ethanol has replaced 20 percent of the gasoline used.

One reason for Brazil's lead in this field is that it has a surplus of raw materials. For the most part, Brazilians use sugar cane to produce ethanol, and they have plenty of land to grow it on. But

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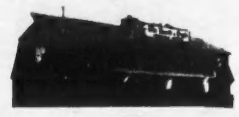

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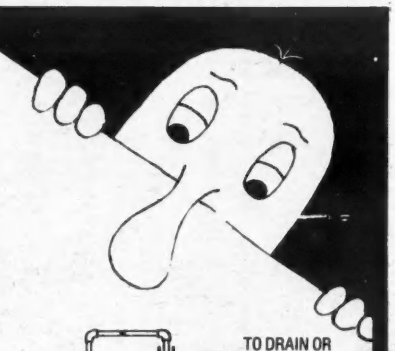

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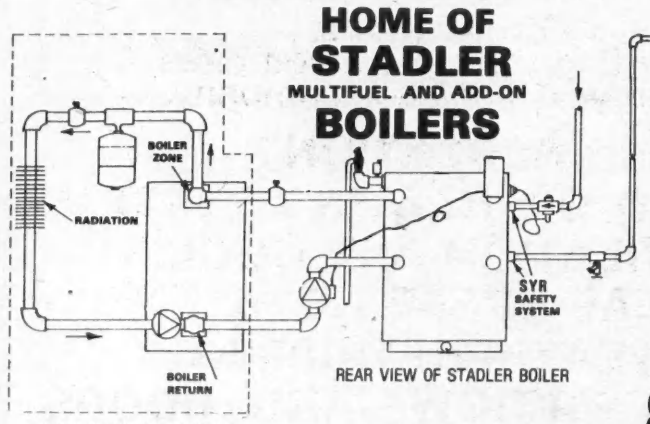

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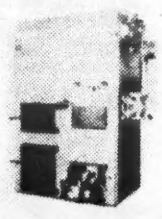

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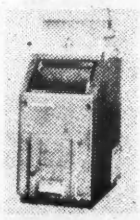

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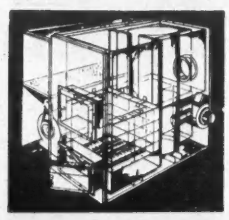

FROM
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virtually any plant will do, and in this country we have concentrated more on processing grains, of which we have a lot. But the best green machine may turn out to be the sugar beet, which gives a yield of 493 gallons of alcohol per acre. Sugar cane gets 650 gallons per acre, but it doesn't grow well in most areas of the US.

Using food for fuel presents us with a moral dilemma. A quarter of the world's population is starving, and it may be the ultimate expression of piggishness to use protein sources for Sunday-afternoon drives in the country. In addition to the ethical questions involved, getting ethanol from plants is simply not very efficient. Another natural alcohol, methanol, may be a better bet, and we can get it more efficiently from pine trees than we can get ethanol from grain. And speaking of trees, Nobel Prize-winning chemist Melvin Calvin has discovered a tree in the Brazilian rain forest whose sap consists of pure diesel fuel. Really.

Designer genes

Nature has provided us with an abundance of plant fuels, but we are on the verge of creating our own. The production of alcohol via fermentation is a process we mastered a long time ago, but until now we have had to depend on relatively inefficient natural anaerobic bacteria to do the job. But the coming of large-scale genetic engineering may soon make it possible to create our own super-efficient fermenting bacteria.

The fuels produced by plants, in whatever form, are manufactured at the molecular level according to formulas built into genetic material in plant cells. We don't need an entire tree if we can decode the instructions in the genes themselves. Moreover, we don't even have to settle for the results of natural programing. New techniques in genetic engineering may make it possible to artificially create bacteria with pre-programed instructions designed to meet the needs of people rather than plants. We will be able to create entirely new species of bacteria who existence is dedicated to the production of high-grade alcohols.

No one seems to be sure when this will happen, but there is general agreement that we are getting tantalizingly close. Genetic engineering scares a lot of people, evoking images of zombie clones, doomsday viruses, and homicidal tomatoes. Valid concerns exist, to be sure, but from the beginning, scientists have taken the lead in developing safeguards in genetic engineering. Experience has shown that many of the early fears are probably groundless; still, tinkering with evolution is not to be taken lightly, and caution remains the watchword in genetic research.

Hot shots

The fireworks at Mt. St. Helens gave us a graphic demonstration of the energy potential of the earth itself. The major eruption at St. Helens was equal in force to a 10-megaton hydrogen bomb; it blew up a cubic mile of rock. There is no conceivable way to harness such a release of energy, but we are already using some of Mother Earth's less extravagant displays. Hot springs and volcanic vents provide a continuous and more or less dependable source of geothermal energy; Iceland already gets much of its energy from such sources.

In most places (fortunately), the earth holds its energy in, trapping it far underground. A new and rather simple technique developed at the Los Alamos Scientific Laboratory may now provide us with a means of tapping some of that energy. The method is quite straightforward: simply drill two holes a couple of miles deep, inject water into one hole, and then pump it out of the other. The returning water carries with it some of the earth's internal heat, which can then be used to drive generators for electricity or can be employed directly as heat in various industrial processes.

In order for the process to be efficient, the water has to make contact with the largest possible surface area of rock. By pumping the water under high pressure, the rocks can be made to fracture, increasing the total surface area exposed to the water. The technique looks very promising, and an experimental five-to-10 megawatt generating station is already under construction in New Mexico. It may not go over so well in California, however; one side-effect of fracturing the rock may be the creation of mini-earthquakes.

The best of the rest

OTEC — Ocean Thermal Energy Conversion. This is essentially the same as the hot-rocks concept, except that it works in reverse and uses sea water. Large-scale attempts are already under way to pump massive amounts of cold, deep ocean water to the surface, heat it with warm surface water, and use it to vaporize ammonia to turn turbines. This technique could produce a lot of energy, but it is very costly and the environmental effects of bringing up so much cold water are questionable.

Fuel Cells. These have been around for a while, but they are getting more efficient. Fuel cells are essentially refuelable batteries that store chemical energy for conversion to electrical energy. The fuel consists of air and hydrogen derived from methanol. The disadvantage of fuel cells is that they don't produce much energy very quickly, making fuel-cell-powered automobiles a bad bet on the expressway. However, there are ways of getting around this problem, and if we can contain our lust for putting the pedal to the metal, fuel cells may become an excellent means of propulsion for urban transport.

Magnetic Heat Pumps. There is a rare metal, gadolinium, that has the useful property of heating up when in the presence of a magnetic field. Heat pumps designed to take advantage of this property have created temperature differentials as great as 150 degrees Fahrenheit. In a solar society where cogenerators utilizing waste heat will be a fixture, the magnetic pumps could make a significant contribution.

Meanwhile . . .

As research and development continue in the promising new fields already noted, the government has been more concerned with finding ways to get at and use coal and oil shale. The advantage to coal and oil shale is that we have one hell of a lot of them. The disadvantages would fill several volumes, but following are a few of the lowlights.

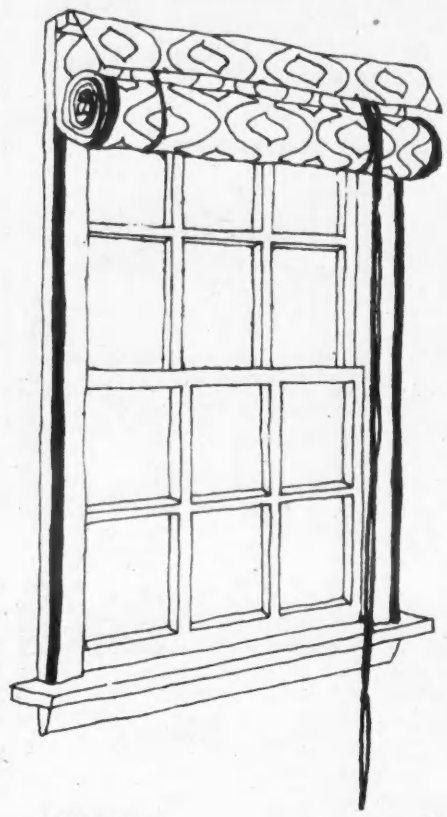
Although we have enough coal in shale to last four or five hundred years, getting it from the ground to your furnace will be incredibly expensive and destructive. The same applies to oil shale, only more so. The sad fact is that our railroad system is inadequate to handle a massive shift back to coal; we'd almost have to rebuild it. And since most of our remaining coal and oil shale are inconveniently located underneath the Rocky Mountains, consider, if you will, what a flat Colorado would look like. Even if we don't mind tearing down the Rockies, processing oil shale requires prodigious quantities of water, which is already getting scarce out West.

The worst thing about coal and oil shale is what they do to the atmosphere. The ominous ramifications of things like breeder reactors and SPS systems are still only theoretical; but the environmental damage done by fossil fuels has already reached the danger point.

When you burn hydrocarbons, you inevitably and unavoidably pump carbon dioxide and other, more complex chemical compounds into the atmosphere. That doesn't get rid of them. Before the industrial revolution, the atmosphere contained about 265 parts per million (PPM) of carbon dioxide. Today, it contains about 330 PPM, and by the turn of the century the figure will exceed 400 PPM. Carbon dioxide traps heat ("the greenhouse effect"), and there is solid evidence that carbon-dioxide pollution is gradually raising the mean global temperature. Some scientists believe that by the end of the century, the mean global temperature will increase by one to two degrees centigrade. That doesn't seem like much, but it could be more than enough to melt the polar ice caps, raising sea level by as much as 25 feet. That would be very bad news for anyone living in New Orleans, Houston, the Netherlands — or Boston.

This situation sounds like a bad Irwin Allen disaster flick, but it's not. A lot of scientists who have studied the problem are getting very worried. The kicker is that we can't be sure it's happening until it is already too late to do anything about it. We may, in fact, already have reached that point. Stay tuned.

The irony, of course, is that we don't even need to burn all that coal. The energy sources mentioned here — plus some others which are even more exotic — can give us all the power we will ever need. The choice is ours. ●



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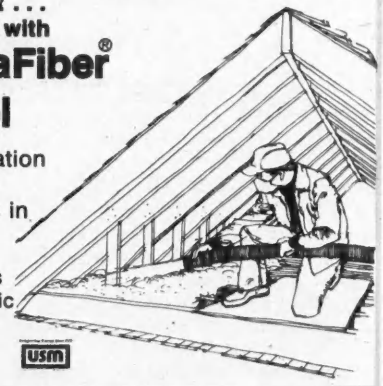

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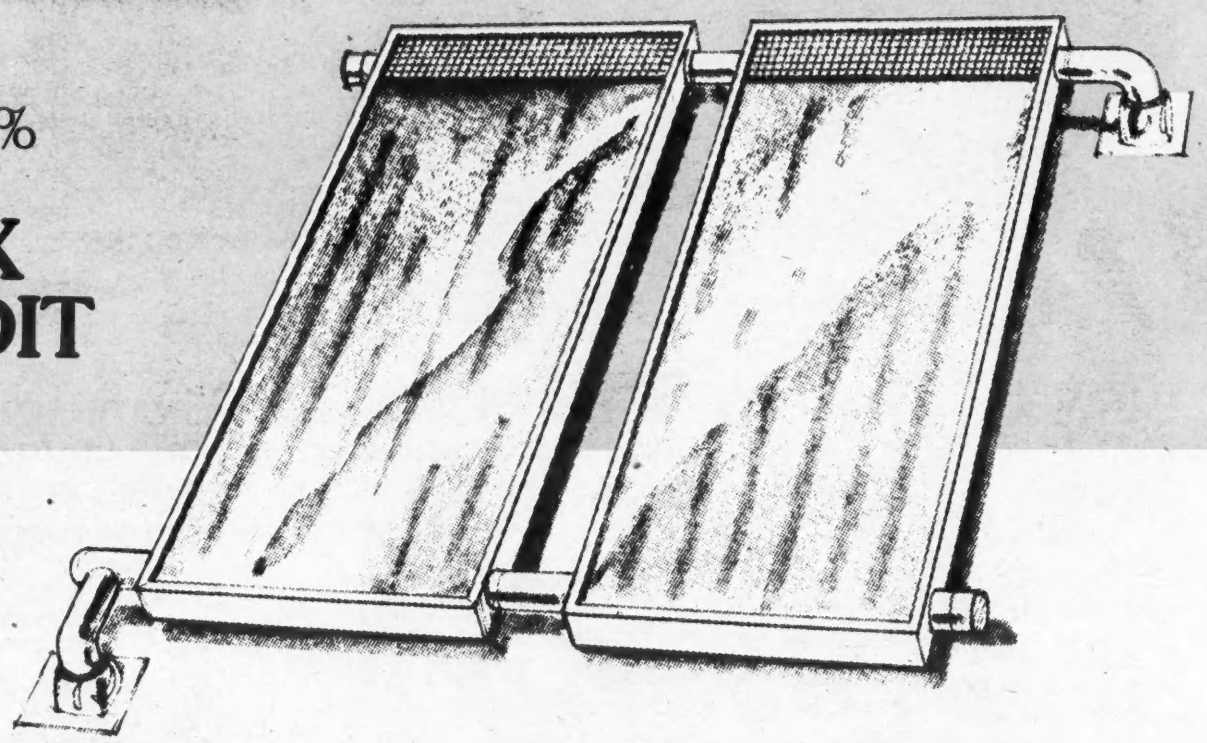

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